The Health Related Quality of Life of Survivors of Critical Illness as measured with the SF-36 and EQ-5D Questionnaires at six months after discharge.

JENNY SCHNEIDERMAN

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Masters of Science in Physiotherapy.

Johannesburg, 2011

Declaration

I, Jenny Schneiderman, declare that this research report is my own work. It is being submitted for the degree of Masters of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

27 day of September, 2011

Abstract

Objectives:

To establish the health-related quality of life (HRQOL) of survivors of critical illness as a result of trauma six months after discharge from the intensive care unit (ICU) and to determine which HRQOL measurement tool is more suitable to use in this population. To relate demographic characteristics and other outcome measures to HRQOL as reported six months after ICU discharge with the Short Form-36 (SF-36) Medical Outcomes questionnaire and EQ-5D questionnaire respectively.

Methods:

A retrospective cross-sectional cohort study was conducted to assess HRQOL at six months after ICU discharge for survivors of trauma who were treated with mechanical ventilation. Twenty eight (n=28) subjects were recruited from two ICUs in Johannesburg, South Africa. Health-related QOL was assessed with the SF-36 English UK version and the EQ-5D questionnaires. Demographic (age, gender) and outcome measure [Acute Physiology and Chronic Health Evaluation (APACHE) II, Injury Severity Score (ISS), ICU and hospital length of stay (LOS)] information was related to HRQOL.

Results:

The HRQOL reported by subjects showed limitations when measured with the EQ-5D and SF-36. EQ-5D data revealed that 50% of subjects reported some problems in mobility, 35% in self-care and 67.9% in usual activities. Furthermore, 60.7% reported some problems in pain/discomfort and 7.1% reported extreme problems in this domain. With regard to the anxiety/depression domain, 46.4% reported some problems whilst 7.1% reported extreme problems. The mean score for the EQ-5D visual analogue scale (VAS) was found to be 68 (± 26.1). Statistical significance was found in the relationships between age and EQ-VAS ($p = 0.05$; $r = -0.4$) where a moderate correlation was observed, ICU length of stay (LOS) and the mobility domain ($p = 0.01$), hospital LOS and the mobility domain ($p = 0.04$), hospital LOS and the self-care domain ($p = 0.04$) and

the APACHE II score and the usual activities domain (p = 0.05). With respect to the HRQOL as measured with the SF-36 questionnaire, subjects were found to have not achieved optimal HRQOL in any of the domains nor with regard to the summary scores. Lowest scores were found in the role physical (RP) [44.6 (± 41.6)] and role emotional (RE) [44.1 (± 45.4)] domains. The physical component summary score (PCS) [62.1(± 27.8)] was slightly higher than the mental component summary score (MCS) [58.7(± 20.1)]. Statistical significance and a strong correlation was found in the association of age and physical functioning (PF) (p = 0.00; r = -0.6). The association between age and general health (GH) (p = 0.02; r = -0.4) yielded a moderate correlation. The same can be said about the association between age and physical component summary score (PCS) (p = 0.01; r = -0.5). PF was also significantly associated with ICU (p = 0.03; r = -0.4) and hospital (p = 0.03; r = -0.4) LOS and a moderate correlation was shown between these variables.

Conclusion:

At six months after ICU discharge, HRQOL for these subjects was not optimal. Age, ICU and hospital LOS seemed to be associated with limitations in HRQOL related to function while severity of illness had a lesser effect. The EQ-5D questionnaire proved to be simpler and more user-friendly in ascertaining the HRQOL of trauma survivors; however the SF-36 gave more detailed information about HRQOL. Patients who experienced trauma might benefit from a rehabilitation programme after discharge from hospital to address the functional impairments in HRQOL observed with this study.

Acknowledgements

I would like to thank the following people:

- My supervisor, Dr H van Aswegen for her valuable advice which helped me tremendously in the completion of this research report.
- Kirsten Peterson, who assisted me with the recruitment of subjects.
- Professor P Becker for his help with statistical analysis.
- The staff of the respective hospitals who aided in data collection.

Table of Contents

Declaration *2*

Abstract *3*

Objectives: **3**

Methods: **3**

Results: **3**

Conclusion: **4**

Chapter 1 ..... *11*

Introduction *11*

1.1 Background **11**

1.2 Statement of problem and justification for research **13**

1.3 Research Question **13**

1.4 Significance of Research **13**

1.5 Research Aims **14**

1.6 Research Objectives **14**

1.7 Type of study **14**

Chapter 2 ..... *16*

Literature Review *16*

2.1 Why measure health related quality of life? **16**

2.2 Instruments used to measure health related quality of life **17**

2.2.1 SF-36 questionnaire 17

2.2.2 EQ-5D questionnaire 19

2.3 When to measure health related quality of life **20**

2.4 Severity of illness scoring systems and health related quality of life as a predictor of mortality **22**

2.5 Health related quality of life by diagnostic category **23**

2.6 Variables that influence health related quality of life **24**

2.6.1 Demographics 24

2.6.2 Pre-existing disease 26

2.6.3 Sepsis and multiple organ failure 26

2.6.4 Compensation-related variables 29

Chapter 3 ..... *30*

Methods *30*

3.1 Study Design **30**

3.2 Research Method **30**

3.3 Variables **30**

3.4 Hypotheses **31**

3.5 Sample Size and Selection **31**

3.6 Inclusion Criteria **31**

3.7 Exclusion Criteria **32**

3.8 Data Collection **32**
3.9 Data Analysis **33**
3.10 Ethical considerations **34**
Chapter 4 ..... ***35***
Results ***35***
4.1 Study population **35**
4.2 Results based on EQ-5D questionnaire **37**
4.2.1 Health related quality of life as measured with the EQ-5D 37
4.2.2 Comparison of EQ-5D domains with demographics and outcomes 38
4.3 Results based on SF-36 questionnaire **41**
4.3.1 Health related quality of life as measured with the SF-36 42
4.3.2 Comparison of SF-36 domains with demographics and outcomes 42
4.4 Comparison of the SF-36 and EQ-5D questionnaires **43**
Chapter 5 ..... ***46***
Discussion ***46***
5.1 The Health related quality of life of survivors of critical illness as a result of trauma **46**
5.1.1 Demographic characteristics of the study population 46
5.1.2 Health related quality of life as measured with the EQ-5D 47
5.1.3 Health related quality of life as measured with the SF-36 49
5.2 Factors that affected health related quality of life **51**
5.2.1 Gender 51
5.2.2 Age 52
5.2.3 Length of stay in the intensive care unit and hospital 52
5.2.4 Severity of illness 53
5.3 Exercise and its potential role in the rehabilitation of survivors of trauma **53**
5.4 Limitations and recommendations **55**
5.5 Conclusion of Discussion Section **56**
Chapter 6 ..... ***57***
Conclusion ***57***
References ***58***
Appendices ***64***
Appendix One: SF-36 Questionnaire **65**
Appendix Two: EQ-5D Questionnaire **72**
Appendix Three: Ethics clearance **76**
Appendix Four: Permission from hospitals to conduct research **78**
Appendix five: Informed consent **81**
Appendix six: Information document **83**
Appendix seven: Data collection sheet **87**

List of Tables

Table 1: Demographic and outcome information for enrolled subjects.

Table 2: Report of descriptive portion of EQ-5D.

Table 3: Comparison of EQ-5D domains with trauma type and gender.

Table 4: Relationship between EQ-5D health states and outcome measures.

List of Figures

Figure 1: Distribution of subjects according to type of trauma.

List of Abbreviations

AIDS: Acquired immunodeficiency syndrome

ADL: Activities of daily living

ANOVA: Analysis of variance

APACHE: Acute Physiologic and Chronic Health Evaluation

APC: Activated protein C

BP: Bodily pain

GH: General health

HIV: Human immunodeficiency virus

HRQOL: Health related quality of life

ICU: Intensive care unit

IL-1: Interleukin-1

IL-6: Interleukin-6

IL-10: Interleukin-10

ISS: Injury severity score

LDL: Low density lipoprotein

LOS: Length of stay

MCS: Mental component score

MH: Mental Health

PCS: Physical component score

PF: Physical functioning

RE: Role emotional

RP: Role physical

SAPS: Simplified Acute Physiology Score

SF: Social functioning

TF: Tissue Factor

TFPI: Tissue factor pathway inhibitor

TNF: Tumour necrosis factor

QOL: Quality of life

VAS: Visual Analogue Scale

VT: Vitality

Chapter 1
Introduction

1.1 Background

Intensive care is a major source of health service expenditure and is associated with a high mortality. Success in the treatment of the critically ill in the intensive care unit (ICU) is predominantly measured as survival. However, the health-related quality of life (HRQOL) of such patients is very rarely taken into account (Eddleston, White, Guthrie 2000). If ICU treatment leads to deterioration in quality of life (QOL), patients may be concerned that slight improvements in life expectancy come at too high a cost. Interventions can maintain life in the critical care setting, but the resultant health state may not be satisfactory. Thus, it may be argued that ICU physicians should be concerned with improving how people perceive their QOL post ICU discharge rather than simply prolonging their lives.

Injuries accounted for nine percent of deaths and 12% of the burden of disease worldwide in the year 2000. The high proportion of deaths from injuries in South Africa has been identified as one part of the quadruple burden; this is in addition to causes related to poverty, chronic disease and HIV/AIDS (Norman, Matzopoulos, Groenewald, Bradshaw 2007). It was estimated that the annual trauma caseload at secondary and tertiary level health facilities was approximately 1.5 million (40 per 1000 population) in the year 1999, with Gauteng hospitals reporting the highest average of cases (Matzopoulos, Prinsloo, Buchart, Peden, Lombard 2006). In contrast to worldwide statistics where road traffic injuries are responsible for the highest injury mortality, in South Africa, road traffic injuries rank second to interpersonal violence. However, the road traffic fatality rate in South Africa is almost double the global average (Norman et al, 2007). Moreover, pedestrians are involved in more than half of the road traffic fatalities. Homicide was the leading cause of death in males and road traffic injuries ranked second; this order was reversed in females in the year 2000. The homicide rate in 2000 was said to be nine

times the global rate placing South Africa among the most violent countries in the world (Norman et al, 2007). It is important to consider the non-fatal aspect of these statistics as for each death there are several survivors with permanent sequelae as a result of the injuries sustained.

Of those surviving trauma, some are admitted to ICU for care. Due to the severity of their injuries and the consequential management, bed rest is often inevitable. The decrease in physical activity as a result of bed rest can result in a reduction in the functional capacity of the musculoskeletal system (Topp, Ditmyer, King, Doherty, Hornyak 2002). One of the deleterious effects of immobilization is that of muscle atrophy and accompanying loss of strength and contractility. Skeletal muscle strength is said to decline by one to one and a half percent per day after bed rest with loss of strength being able to decline by as much as 40% after the first week. Furthermore, antigravity muscles have been shown to lose contractile proteins with an increase in noncontractile tissue content such as collagen while the total number of muscle fibres remains unchanged (Topp et al, 2002). Moreover, a period of immobilization results in a greater proportion of bone resorption than bone formation thus leading to a resultant decrease in bone mass (Topp et al, 2002). In addition to the detrimental effects to the musculoskeletal system, bed rest has adverse effects on the cardiovascular system. The heart muscle too may atrophy leading to a decrease in stroke volume, increase in heart rate and a resultant decline in cardiac capacity and thus exercise tolerance (Topp et al, 2002).

Although information is available about the detrimental physical effects of an ICU stay, little is known about the QOL of these trauma victims after ICU stay in the South African context. By examining the HRQOL of the critically ill population, we may begin to understand the needs and problems that this population faces. By so doing, systems and programmes for the care of such patients after ICU discharge may be developed. With the institution of such programmes we aim at improving the patients' HRQOL and the overall quality of ICU care that our patients receive.

1.2 Statement of problem and justification for research

Patients with trauma who are treated in ICU with mechanical ventilation suffer from muscle weakness and dysfunction due to the effects of critical illness and prolonged bed rest on the human body. Prolonged recovery after ICU discharge is likely to impact on the micro and macro economy of South Africa. Little is known about the QOL of trauma survivors after ICU discharge in the South African context. Rehabilitation programmes exist in South Africa for patients with chronic cardiac and/or pulmonary diseases, which have been shown to be effective in improving these patients' abilities to participate in cardiovascular exercises (improving ability to cope with work and activities of daily living [ADL]) and play a role in improving these patients QOL. Without knowledge of possible limitations in the QOL of survivors of trauma, it is not known whether they too would benefit from a rehabilitation programme after discharge from the hospital.

1.3 Research Question

What is the HRQOL of survivors of critical illness as a result of trauma? Which QOL tool is best suited to assess QOL of ICU survivors at six months post discharge?

1.4 Significance of Research

Much research has been done on the HRQOL of patients after ICU discharge in other areas of the world, particularly in Europe. There is, however, little known about the HRQOL of patients after ICU discharge in the South African population. Since there are obvious differences between European and African demographics, there becomes a need to investigate the HRQOL specifically of South African patients in order to come to relevant conclusions about our population and develop programmes accordingly. Although many tools have been used in the literature, the EQ-5D and SF-36 proved to be popular instruments in the assessment of HRQOL in the ICU populations in other parts of the world. In the South African population, the EQ-5D proved to be popular in measuring the HRQOL in non-ICU populations (Louwagie, Bachmann, Meyer, Booysen, Fairall, Heunis 2007; Jelsma, Maclean,

Hughes, Tinise, Darder 2005; Hughes, Jelsma, Maclean, Darder, Tinise 2004; Jelsma, Mkoka, Amosun, Nieuwveldt 2004). However, the use of the SF-36 in the South African population has been scarce (Van Aswegen, Eales, Richards, Goosen, Becker 2010; Benitha and Tikly 2007; O'Keefe and Wood 1996). It thus becomes relevant to investigate the HRQOL of survivors of trauma and to establish which QOL tool is more suitable in the South African context.

1.5 Research Aims

a) To establish the HRQOL of survivors of critical illness as a result of trauma measured at six months after discharge.
b) To establish which tool would be more appropriate to use when assessing HRQOL in ICU survivors.

1.6 Research Objectives

- To establish the HRQOL of survivors of critical illness who underwent mechanical ventilation as a result of trauma six months after ICU discharge in Johannesburg, South Africa with the SF-36 and EQ-5D questionnaires.
- To relate severity of illness to HRQOL as reported six months after ICU discharge in the SF-36 and EQ-5D.
- To relate LOS in ICU and in hospital to HRQOL as reported six months after ICU discharge in the SF-36 and EQ-5D.
- To relate demographic information to HRQOL as reported six months after ICU discharge in the SF-36 and EQ-5D.
- To determine subjectively which of the two HRQOL measurement tools (SF-36 or EQ-5D) is more appropriate to use in the trauma population in Johannesburg, South Africa.

1.7 Type of study

A cross-sectional cohort study was conducted to assess QOL at six months after ICU discharge for survivors of trauma who were treated with mechanical ventilation.

Chapter 2 consists of an in-depth discussion of the literature on health-related QOL and the effects of trauma on the human body. The effects of critical illness and prolonged immobilisation on the human body are also discussed as well as the effects of critical illness on the QOL of survivors.

Chapter 2
Literature Review

2.1 Why measure health related quality of life?

HRQOL is defined as a perceived state of physical, mental and social well being (Combes, Costa, Trouillet, Baudot, Mokhtari, Gibert, Chastre 2003). A QOL assessment should reflect the patient's physiological and psychological status, it is the HRQOL that takes into account those dimensions that are influenced by the disease and its treatment (Hofhuis, van Stel, Schrijvers, Rommes, Bakker, Spronk 2009).

Intensive care units provide care for critically ill patients with a wide range of conditions. A question can be posed as to what it truly means to survive intensive care. Whilst the ICU provides treatment aimed at decreasing mortality, the reality of this setting is that many are left with physical and/or mental impairments. There remains a wide range of serious outcomes in those who have survived intensive care. Many suffer from ongoing morbidity, neurocognitive defects, poor functional capabilities, and decreased return to work and usual activities, just to name a few. Therefore, not only should the survival of these patients be considered in the intensive care setting but also the quality of that survival after ICU discharge (Angus and Carlet 2003).

QOL of ICU survivors after hospital discharge improves but remains lower than general population levels (Dowdy, Eid, Sedrakyan, Mendez- Tellez, Pronovost, Herridge, Needham 2005). It is thus important to ascertain the exact degree of disabilities and the impact of such on QOL of patients after ICU discharge. Examining these outcomes allows us to understand the needs and problems of ICU survivors and to develop systems for the care of patients after ICU discharge.

2.2 Instruments used to measure health related quality of life

Hofhuis et al (2009) noted that an ideal generic instrument in ICU patients should be simple to administer, should not overwhelm the patient yet be sensitive enough to slight changes in QOL.

The SF-36 and EQ-5D questionnaires have been recommended as the best suited instruments for measuring QOL in the critical care setting (Angus and Carlet 2003). This review will focus on these two instruments.

2.2.1 SF-36 questionnaire

The SF-36 questionnaire was first made available in its developmental form in 1988 and in its standard form in 1990 (Ware Jr and Sherbourne 1992). It was developed as part of the Medical Outcomes Study. The SF-36 questionnaire comprises 36 questions consisting of eight dimensions: physical functioning (PF), social functioning (SF), role limitation due to physical problems (RP), role limitation due to emotional problems (RE), mental health (MH), vitality (VT), bodily pain (BP) and general health perceptions (GH). The physical component summary score (PCS) comprises the PF, RP, BP and GH domains. The mental component summary score (MCS) comprises the VT, SF, RE and MH domains (Hofhuis et al, 2009). The SF-36 can be self-administered or interviewer administered. Furthermore the questionnaire can also be completed by proxies when the patient is unable to do so (Hofhuis, Hautvast, Schrijvers, Bakker 2003). The scores on all subscales are transformed to a scale of 0 (worst score) to 100 (best score) (Orwelius, Nordlund, Nordlund, Simonsson, Backman, Samuelsson, Sjoberg 2010).

The SF-36 was demonstrated to have good acceptability, reliability and validity in the ICU population (Black, Jenkinson, Hayes, Young, Vella, Rowan, Daly, Ridley 2001; Cuthbertson, Scott, Strachan, Kilonzo, Vale 2005). Heyland, Hopman, Coo, Tranmer, McColl (2000) evaluated the reliability and validity of the SF-36 in survivors of sepsis in the ICU setting. Test-retest reliability was shown to be ≥ 0.75 for each of the eight domains of the SF-36. Furthermore, Cronbach's alpha showed that internal consistency exceeded 0.70 for both summary scales (MCS and PCS) as well as seven of the eight

domains of the SF-36. Thus the SF-36 demonstrated good reliability and validity as well as high internal consistency and excellent test-retest stability in this context. Dowdy et al (2005) conducted a systematic review of the literature investigating the QOL specifically of ICU survivors. Of the 26 studies reviewed, ten utilized the SF-36 questionnaire. All studies where the SF-36 was used, reported significant decreases in HRQOL compared with a matched general population. In examining the HRQOL of patients with multiple organ failure in the ICU setting, Wehler, Geise, Hadzionerovic, Aljukic, Reulbach, Hahn, Strauss (2003) explored the measurement properties of the SF-36. Cronbach's alpha for internal reliability ranged from 0.73 to 0.96 and test-rest reliability was shown to be 0.87-0.96 in all domains and in the two component scores.

Various studies have used the SF-36 in the South African context. Benitha and Tikly (2007) assessed functional disability and HRQOL in South Africans with rheumatoid arthritis and systemic lupus erythematosus using the English version of the SF-36 questionnaire. Both rheumatoid arthritis and systemic lupus erythematosus groups fared significantly worse in all domains of the SF-36 thus indicating a diminished HRQOL. O' Keefe and Wood (1996) investigated the HRQOL of HIV subjects in South Africa. The authors found that HIV-infected patients scored much lower than healthy subjects on all scales of the SF-36. Furthermore, most of the decline in physical function took place early in HIV disease when symptoms had not appeared. Another study that utilized the SF-36 in the South African context is that of van Aswegen et al (2010). This study looked at the effect of penetrating trunk trauma and mechanical ventilation on the recovery of survivors after hospital discharge. In their investigation of the HRQOL of these survivors, statistically significant differences were found between the groups who underwent a short period of mechanical ventilation (< 5 days) to those who underwent a prolonged period (≥ 5 days) at six months after hospital discharge. Differences were evident in the PF, BP and GH domains as well as in the PCS in that those who underwent prolonged ventilation reflected worse scores. There was however no difference noted in the MCS at six months (van Aswegen et al, 2010). Moreover, Karachi, Hanekom, Faure (2011) utilized the SF-36 in ascertaining the HRQOL of patients 12 months after discharge from a surgical ICU in the Western Cape. All SF-36 domain and summary scores were decreased with PF, RP

and RE exhibiting the lowest values. Thus, in this sample, a reduction in HRQOL was evident.

In contrast to the SF-36, the EQ-5D is less well validated in the ICU population (Cuthbertson et al, 2005).

2.2.2 EQ-5D questionnaire

The EQ-5D questionnaire was developed by the EuroQol group to provide a simple and generic measure of health as the group felt that generic measures available in the 1980s were limited in evaluating health care interventions (Cheung, Oemar, Oppe, Rabin 2009). The EQ-5D is designed for self completion by respondents.

The EQ-5D consists of two parts: the EQ-VAS, where a visual analogue scale (VAS) is used to rate the participant's health perception; and a descriptive portion whereby the participant depicts health problems according to a five-item classification, that is, mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each classification has three alternatives (1 = no problems, 2 = moderate problems and 3 = severe problems) (Hofhuis et al, 2009). The descriptive system defines a total of 243 possible health states. The participant is asked to place a tick or cross against the most appropriate alternative. This decision results in a one digit number depicting the level for that dimension. The digits for the five dimensions are combined to express a five digit number describing the participant's health state (Cheung et al, 2009). The EQ-VAS records the participant's state of health on a vertical VAS where the end-points are labeled 'best imaginable state of health' corresponding to the number 100 and 'worst imaginable state of health' corresponding to the number 0. Respondents are asked to rate their health by drawing a line from a box marked 'your health state today' to the appropriate point on the VAS which correlates to their perceived state of health. A three digit number between 000 and 100 is read off the scale where the participant marked the VAS (Cheung et al, 2009).

In the South African scenario, the Xhosa version of the EQ-5D has been deemed a valid and reliable instrument (Jelsma et al, 2004). In the local context, the EQ-5D has been

used to assess the HRQOL of patients outside the ICU setting. Jelsma et al (2005) and Louwagie et al (2007) used the EQ-5D to ascertain the HRQOL of patients with HIV/AIDS who received highly active antiretroviral treatment. In their investigations into the HRQOL of patients with HIV/AIDS, Hughes et al (2004) and Robberstad and Olsen (2010) also utilized the EQ-5D questionnaire. Robberstad and Olsen (2010) found the EQ-5D to be a good tool for investigating the HRQOL for subjects with HIV/AIDS as it was easy to assess and was sensitive to differences in health states. Furthermore, Bhargava and Booysen (2009) found that emotional support received by HIV/AIDS patients was a significant predictor of CD4 cell counts and QOL indices. This conclusion was reached when patients were asked to fill out the EQ-5D questionnaire.

Although both instruments have been recommended for assessment of HRQOL in the ICU setting abroad, a choice still needs to be made as to which is more appropriate to use in South Africa. The EQ-5D requires less time to complete and is a simpler instrument to use, however, the SF-36 covers more domains and is more precise (Hofhuis et al, 2009). Thus the choice of instrument should depend on the research questions and the context of that which is being investigated.

2.3 When to measure health related quality of life

The appropriate time to evaluate the HRQOL following ICU discharge has not been established (Hofhuis, Spronk, van Stel, Schrijvers, Rommes, Bakker, 2008). Many studies have examined HRQOL at varying times post ICU discharge. Eddleston, White, Guthrie (2000), Cuthbertson et al (2005) and Hofhuis et al (2008) assessed HRQOL at three months post ICU discharge. Wehler et al (2003), Cuthbertson et al (2005), Orwelius et al (2010) and Hofhuis et al (2008) assessed HRQOL at six months following ICU discharge. Moreover, Cuthbertson et al (2005), Badia, Diaz-Prieto, Gorriz, Herdman, Torrado, Farrero, Cavanilles (2001), Orwelius et al (2010) and Myhren, Ekeberg, Stokland (2010) evaluated HRQOL at 12 months post ICU discharge. Eddleston et al (2000) found that when HRQOL was measured at three months after ICU discharge in a mixed ICU population, approximately 80 % of all patients reported that they were satisfied with their QOL. This is in contrast to the findings of Cuthbertson et al (2005)

who investigated HRQOL in a mixed ICU population in the same time frame. Cuthbertson et al (2005) noticed a decrease in HRQOL at three months after ICU discharge whilst also noting an increase in HRQOL to baseline at 12 months. In their research, Hofhuis et al (2008) established that HRQOL improved at three and six months after ICU discharge compared to at ICU stay and hospital discharge in patients with severe sepsis. A gradual improvement occurred in the six months after ICU discharge in all dimensions of the SF-36 except for BP and the MCS. However, scores for PF, RP and GH dimensions were still significantly lower than baseline values (Hofhuis et al, 2008). Wehler et al (2003) however, found that at six months after ICU discharge, the majority of patients had regained their previous HRQOL. Myhren, Ekeberg, Stokland (2010) discovered that survivors of critical illness had significantly lower HRQOL at one year after ICU discharge compared to the general population as well as reduced scores compared to their states before ICU admission. This result was obtained when a mixed ICU population was studied. Orwelius et al (2010) found survivors of critical illness (mixed ICU population) to not experience any significant increase in HRQOL after six months and only minor improvements up to 36 months after ICU and hospital discharge. There were no statistically significant changes in any SF-36 dimensions' mean-score except for PF between six and 24 months with improvements from 66.3 to 70.1 ($p=0.002$), RP between six and 12 months with improvements from 47.8 to 56.5 ($p< 0.001$) and SF between six and 12 months with improvements from 73.0 to 76.9 ($p=0.008$). It seems that changes in HRQOL after the six month period after ICU discharge are reported to be minimal in the other domains of the SF-36 (Hofhuis et al, 2008; Orwelius et al, 2010).

The changes in HRQOL following ICU discharge and during a ward stay was investigated by Hofhuis et al (2008). It was found that HRQOL decreased in all dimensions during ICU stay followed by rapid improvement during hospital stay in a mixed ICU population. HRQOL improved to near pre-ICU values at six months post ICU discharge. Physical functioning, GH and SF remained significantly lower than pre-ICU values. The improvement of HRQOL during the general ward stay was the most significant in HRQOL for the whole follow-up period. Thus, the recovery of HRQOL

already starts at ICU discharge and as a consequence the commencement of rehabilitation programmes should start earlier (Hofhuis et al, 2008).

2.4 Severity of illness scoring systems and health related quality of life as a predictor of mortality

Two scoring systems are commonly used in assessing the severity of illness in critically ill trauma patients, namely the Acute Physiology and Chronic Health Evaluation score (APACHE II) and Injury Severity Score (ISS).

The APACHE II assigns numerical values to 12 parameters: temperature, mean arterial blood pressure, heart rate, respiratory rate, oxygenation, arterial pH, serum sodium, potassium and creatinine, white blood cell count and Glasgow Coma Scale. The combined score from these 12 parameters is combined with scores for age group and pre-existing disease. Combined scores below 10 indicate relatively mild illness while those above 15 indicate moderate to severe illness (Dossett, Redhage, Sawyet, May 2009). In their study to investigate the superiority of scoring systems in critically ill trauma patients, Dossett et al (2009) found APACHE II was the best predictor of mortality. This is in agreement with Rutledge, Fakhry, Rutherford, Muakkassa, Meyer (1993) where the APACHE II was found to be the best predictor of outcome in trauma patients. In the South African context, van der Merwe, Kidd, Metzker, Bolliger, Irusen (2005) found the APACHE II to accurately describe the risk of death in ICU.

The ISS is an anatomical scoring system. Each of six body regions (head and neck, face, chest, abdomen, extremity and external) is assigned an abbreviated injury score. The three most severely injured regions have their score squared and added together to produce the ISS. Scores can range from 0 -75; the higher the score, the more severe the injuries (Dossett et al, 2009).

Severity of illness (as measured with the ISS and APACHE II) on admission to ICU has been reported to have an influence on HRQOL after discharge from hospital (Ulvik, Kvale, Wentzel-Larsen, Flaatten, 2008; Dowdy et al, 2005). When investigating the HRQOL of survivors of trauma two to seven years after discharge from ICU, Ulvik et al

(2008) found ISS to be significantly associated with impaired HRQOL, particularly mobility problems. Similarly, in their review of the literature, Dowdy et al (2005) noted that 67% of studies found a significant association between severity of illness, as measured with the APACHE II, and a reduced HRQOL.

Hofhuis, Spronk, van Stel, Schrijvers, Bakker (2007) investigated whether HRQOL assessed before admission to the ICU could be used as a predictor of mortality. Proxies were asked to fill in the SF-36 questionnaire within the first 48 hours of admission. It was found that pre-admission HRQOL is in fact as good at predicting mortality in ICU patients as the APACHE II score. It is noted however, that the value of using HRQOL as a predictor of mortality in clinical practice is limited, although it does carry the advantage of being easily obtainable as soon as the patient or proxy can be questioned. The decision of whether a patient should be admitted into the ICU or not should be done on an individual case basis, however, the incorporation of an assessment of HRQOL before ICU admission may be advantageous (Hofhuis et al, 2007).

2.5 Health related quality of life by diagnostic category

Badia, Diaz-Prieto, Gorriz, Herdman, Torrado, Farrero, Cavanilles (2001) suggested that a more accurate picture of ICU outcomes can be ascertained if the diagnostic category of ICU admissions is considered. Due to the fact that ICU patients differ in the cause of their admission and thus diagnostic category, the expectations of their health and well-being after critical illness is also expected to differ. Badia et al (2001) and Granja, Teixeira-Pinto, Costa- Pereira (2002) looked at the HRQOL by diagnostic category. Both studies divided patients into categories of scheduled surgery, unscheduled surgery, trauma and medical conditions. In both studies, the trauma group experienced more problems in the dimensions of the questionnaire (dimensions namely: mobility, self-care, usual activities, pain/discomfort and anxiety/depression). This can be expected as these patients are assumed to have a good HRQOL pre-trauma. This is in contrast to the scheduled surgery groups who has previously reduced HRQOL and undergo surgery to improve their HRQOL and morbidity.

When investigating the HRQOL of trauma patients exclusively, Ulvik et al (2008) found that a total of 74% of these patients experienced a reduction in HRQOL measured at two to seven years post ICU discharge. No patient reported improvement in HRQOL in any dimension compared with status before trauma. This reduction in HRQOL in trauma patients is in agreement with the results of Myhren, Ekeberg, Stokland (2010) who found that HRQOL before ICU stay was significantly higher in trauma patients compared to surgical and medical patients. Furthermore, trauma patients were found to have the largest decline in both physical and mental scores. In their review of the literature, Dowdy et al (2005) concluded that in those studies which examined patients who survived trauma, 100% demonstrated significantly worse pain/discomfort on EQ-5D as compared with other ICU survivors at 6-18 months post discharge. Van Aswegen et al (2010) reported on the HRQOL of patients with penetrating trunk trauma, the HRQOL of other trauma patients in the South African context however, has not yet been investigated.

2.6 Variables that influence health related quality of life

2.6.1 Demographics

In addition to investigating the HRQOL as compared to the diagnostic category, most studies went on further to explore the relationship between HRQOL and socio-demographic and clinical characteristics. These included age, gender, level of education, length of hospital stay (LOS), smoking habits, prior ICU admission, APACHE II score, Simplified Acute Physiology Score (SAPS II) and ISS. Badia et al (2001), Granja, Teixeira-Pinto, Costa- Pereira (2002), Abelha, Santos, Maia, Castro, Barros (2007), Boer, van Ruler, Reitsma , Mahler, Opmeer, Reuland , Gooszen, de Graaf, Hesselink, Gerhards, Steller, Sprangers, Boermeester, De Borgie, Dutch peritonitis group (2007) and Orwelius et al (2010) all found a correlation between LOS and the HRQOL. Those patients who had a longer LOS reported more problems on the functional impairment dimensions. The studies by Granja, Teixeira-Pinto, Costa- Pereira (2002), Cuthbertson et al (2005), Ulvik et al (2008) and Hofhuis et al (2008) revealed that background variables such as gender, age, main activity, education, smoking habits, previous health status were in general not

associated with the HRQOL measures studied. This is in contrast to the studies by Badia et al (2001), Dowdy et al (2005), Abelha et al (2007), Boer et al (2007), Myhren, Ekeberg, Stokland (2010) and Orwelius et al (2010) who did find associations with the background variables, particularly those of age and gender. The studies by Granja, Teixeira-Pinto, Costa- Pereira (2002), Dowdy et al (2005), Ulvik et al (2008) and Badia et al (2001) all concluded that a higher APACHE II and SAPS II score was associated with poorer HRQOL. This is contrast to the findings of Cuthbertson et al (2005), Graf, Koch, Dujardin, Kersten, Janssens (2003), Abelha et al (2007), Kvale, Flaaten (2003), Boer et al (2007), Hofhuis et al (2008) and Orwelius et al (2010). However, care should be taken with the interpretation of this result in the study by Boer et al (2007), as the authors only included patients with an APACHE score of > 10 thus reflecting severe illness and an expected mortality around 30%. The study by Combes, Costa, Trouillet, Baudot, Mokhtari, Gibert, Chastre (2003) investigated an important aspect of ICU care and that is of prolonged ventilation. This study investigated the HRQOL of patients, measured at an average of three years post ICU discharge, who required ≥ 14 days of mechanical ventilation. The authors reported that the HRQOL after prolonged mechanical ventilation was impaired as compared with that of a general population. Orwelius et al (2010), however, found no association between HRQOL and time spent on mechanical ventilation.

Studies by Kaarlola, Tallgren, Pettla (2006) and De Rooij, Govers, Korevaar, Giesbers, Levi, de Jonge (2008) went on further to investigate the specific influence of age on the HRQOL of critically ill patients. Both authors incorporated elderly patients into their studies and utilized the EQ-5D to ascertain the HRQOL of the patients. Kaarlola, Tallgren, Pettla (2006), where HRQOL was measured anywhere from 10 months to seven years post ICU discharge, found that half of the patients assessed their present health state as satisfactory, 30% as good and 12 % as poor. De Rooij et al (2008) measured HRQOL anywhere from one to six years post ICU discharge and found that 83% of patients had no severe cognitive impairment and 76% had no severe physical limitations. Furthermore, the perceived QOL was similar to that of an age-matched general population. These results both indicate a good HRQOL of elderly patients who survive critical care. However, both studies reported high mortality rates of elderly patients in the

ICU and thus the sample used in the study represents only those who were well enough to survive. Furthermore, since elderly patients are generally less physically active than younger patients, it may be expected that they would not report a great reduction in HRQOL compared to a younger population.

2.6.2 Pre-existing disease

Orwelius et al (2010) described the relationship between pre-existing disease and HRQOL. In their study, 980 patients who were admitted to the ICU filled out the EQ-5D and SF-36 questionnaires at six, 12, 24 and 36 months after hospital stay. The authors found only small improvements in HRQOL up to 36 months after ICU admission. Furthermore, ICU-related factors such as APACHE II score, admission diagnosis, time on ventilator, and duration of ICU and hospital stay had little effect on HRQOL. Of the patients who answered the questionnaires at six months, 74% had pre-existing disease. The most common pre-existing diseases that were found to be present in these patients were: cancer, diabetes, cardiovascular and gastrointestinal disorders as well as some miscellaneous conditions. Patients with pre-existing diseases were found to have lower scores on the questionnaires than the previously healthy group. Moreover, the only factor that affected all dimensions in HRQOL outcome was found to be pre-existing disease. Thus the authors concluded that a large proportion of the reduction in the HRQOL after ICU stay is attributable to pre-existing disease. The result of this study is in congruence with that of Myhren, Ekeberg, Stokland (2010) where a high burden of pre-existing chronic illness was found to be an independent risk factor for poorer physical health.

2.6.3 Sepsis and multiple organ failure

Severe sepsis is often associated with multiple organ failure. Severe infection leads to an inflammatory process which may cause changes in peripheral metabolism as well as coagulation and haemodynamic instability ultimately leading to organ failure or death. This alteration in organ function may result in serious sequelae, impaired functional and emotional status and a reduction in HRQOL (Heyland et al, 2000).

Sepsis is considered as an imbalance between proinflammatory reactions (responsible for killing pathogens but may lead to tissue damage) and anti-inflammatory reactions (responsible for limiting excessive inflammation but may result in making the host vulnerable to secondary infections) (Anas, Wiersinga, de Vos, van der Poll 2010). Inflammation is regulated by cytokines. Cytokines include interleukins, tumour necrosis factors (TNF), lymphotoxins, colony-stimulating factors, chemokines as well as a few miscellaneous cytokines. Interleukins can be proinflammatory, anti-inflammatory or both and integrate the host response to injury. Interleukins 1 (IL-1), 6 (IL-6) and 10 (IL-10) are of interest in the pathogenesis of sepsis. IL-1 and IL-6 display proinflammatory properties, however IL-6 also has anti-inflammatory properties by retarding the production of TNF-α and IL-1 and promoting the synthesis of other anti-inflammatory factors. IL-10 is responsible for the involvement in the negative feedback loop of inflammation by inhibiting proinflammatory cytokine production. TNF has two forms: TNF- α and TNF- β and is an early responder to injury and infection. TNF- α initiates the synthesis and release of other inflammatory factors and can cause hyperinflammatory reactions (Winkelman, 2004). IL-1, IL-6 and TNF- α have been implicated in muscle degradation. IL-1A and IL-1B are both toxic to muscle, IL-1B promotes apoptosis in muscle thus leading to a decrease in muscle mass. IL-6 promotes the infiltration of myocytes leading to myocyte degeneration and muscle atrophy. TNF- α overexpression causes alterations in muscle fibres by inducing muscle metabolism, thus leading to a delay in repairs and weakness (Winkelman, 2004). The cholinergic nervous system is involved in attenuating the body's inflammatory responses. Enhanced efferent activity of the parasympathetic nerve endings results in the release of acetylcholine which acts on the receptors of macrophages and suppresses proinflammatory cytokine production (Anas et al, 2010). Patients with sepsis also experience activation of the coagulation system. Tissue factor (TF) is implicated as the primary initiator of coagulation in sepsis. Coagulation is controlled by three major anticoagulant proteins: tissue factor pathway inhibitor (TFPI), antithrombin and activated protein C (APC). During sepsis, the activities of these are impaired, which together with TF-dependant coagulation results in a shift towards a net procoagulant state (Anas et al, 2010).

Jagodic, Jagodic, Podbregar (2006) assessed the long term survival and HRQOL of patients admitted to ICU because of sepsis and trauma (polytrauma, multiple trauma, head injury, or spinal injury). HRQOL was assessed two years after ICU discharge with the EQ-5D questionnaire. It was found that those patients with sepsis had a higher ICU, in-hospital and post hospital discharge mortality as well as poorer long-term outcomes. In those patients where HRQOL was assessed, 82% of patients reported having a problem in at least one dimension of the EQ-5D. However, there was no significant difference found in HRQOL in all dimensions of the EQ-5D between the sepsis and trauma groups. Almost 60% of patients reported problems in usual activities, 56% had pain and 56% had mobility problems; yet 74% described no problems in self-care. A potential limitation of this study is that 50% of patients were lost to follow-up for the assessment of HRQOL. The authors however, believe that the sample that was attained was representative.

Heyland et al (2000) investigated the impact of sepsis on HRQOL of patients post ICU. Sepsis was defined as the presence of a suspected infection or positive blood culture, mechanical ventilation and at least one of the following criteria: heart rate >90 beats/min; fever>38˚C or hypothermia <36˚C or systolic blood pressure <90mmHg despite fluid resuscitation. In addition to the aforementioned characteristics, patients had to have at least one of the following signs of organ dysfunction: metabolic acidosis; arterial hypoxemia; oliguria; coagulopathy or encephalopathy. The SF-36 questionnaire was used to ascertain HRQOL. Heyland et al (2000) found that compared with established norms, survivors of sepsis scored lower on overall physical health as well as for five of the eight SF-36 domains i.e. PF, RP, GH, VT and SF. When considering the scores of overall mental health, the authors found the results not to be significantly different from the general population. Thus it can be concluded that survivors of sepsis had a reduced HRQOL especially in those domains related to physical and social function due to sepsis.

The aforementioned results concur with those of Hofhuis et al (2008). In their research, the authors examined the relationship between severe sepsis and HRQOL using the SF-36 questionnaire at admission, ICU discharge, hospital discharge and at three and six months after ICU discharge. Ninety five patients participated in the study. There was found to be a decline in HRQOL during ICU stay and gradual improvement over the six months after

ICU discharge for SF, VT, RE and MH dimensions. However, at six months after ICU discharge, scores for PF, RP, and GH dimensions were still significantly lower than pre-admission values. Interestingly, the MCS showed a small decline at ICU discharge but recovered rapidly and when assessed again at six months post ICU discharge, it had improved to near normal values.

Wehler et al (2003) found multiple organ dysfunction to be an independent variable associated with poor physical health. Respiratory failure and acute renal failure were discovered to result in worse physical scores compared with other organ system failures. Patients with multiple organ dysfunction had a worse preadmission HRQOL whereby the PCS was significantly lower. The MCS however, did not differ between the two groups. At six month follow-up, survivors of multiple organ dysfunction had deteriorated scores in all physical health domains except BP whereas no differences were evident in dimensions of MH.

2.6.4 Compensation-related variables

Harris, Young, Rae, Jalaludin, Solomon (2008) explored the predictors of general health after major trauma. The authors highlighted the significance of compensation-related variables. It was found that the pursuit of a compensation claim was associated with poorer physical health. However, if the claim was unsettled, this lead to a further decrease in physical health. Similarly, having an unsettled compensation claim was strongly associated with poor mental health. Harris et al (2008) believed that the negative consequence of such was due to the feeling of uncertainty, conflict and financial burden that was experienced when pursuing a compensation claim.

In summary it can be deduced that HRQOL has a significant role to play in the ICU setting. The SF-36 and EQ-5D questionnaires have been deemed appropriate to use in this particular setting. Furthermore, there remain many factors that influence HRQOL and thus patient outcome after discharge from ICU.

The next chapter of this research report will describe the methodology that was followed in order to conduct the proposed study.

Chapter 3
Methods

The methodology discussed in this chapter is based on the findings of the literature review discussed in chapter 2. The study design, sample population, hypotheses tested, data collection procedure and instruments used are discussed in detail. The main methods used for data analysis are given. Ethical considerations are addressed towards the end of this chapter.

3.1 Study Design

A retrospective cross-sectional study was performed on a cohort of adult patients that survived trauma and fitted the inclusion and exclusion criteria for this study. Each patient was allocated a code number in order to maintain confidentiality.

3.2 Research Method

Quantitative data was collected. Quality of life was assessed with the SF-36 and EQ-5D questionnaires in the form of ordinal data.

3.3 Variables

Independent variable:

- HRQOL measured at six months after ICU discharge.

Dependent variables:

- Length of ICU and hospital stay
- Severity of illness
- Age
- Gender
- Type of trauma (orthopaedic, penetrating/blunt trauma)

3.4 Hypotheses

a) Survivors of trauma report a reduction in HRQOL six months after ICU discharge due to severity of illness and a prolonged stay in hospital.

b) The SF-36 questionnaire gives a more appropriate assessment of QOL at six months after ICU discharge than the EQ-5D questionnaire.

3.5 Sample Size and Selection

Patients were recruited from the trauma ICUs at the Charlotte Maxeke Johannesburg Academic and Milpark hospitals in Johannesburg, South Africa. Recruitment of subjects began in May 2009 and extended to October 2010. The sample size was attained from this population and depended on consent and mortality of the subjects approached during the 15 month data collection period. Recruitment at the Charlotte Maxeke Johannesburg Academic hospital ceased in November 2009 due to a lack of relevant records being available at the Records section of that particular hospital. Results from a PhD thesis by Van Aswegen (2008) reported a mean PCS of 57.2 (± 5.5) for survivors of penetrating trunk trauma as measured with the SF-36 at six months after discharge. Using this information, a sample size of 27 subjects would yield a 5-point improvement in PCS at 80% power and alpha of 5%, taking into consideration 10% drop out and 10% non-compliance. However, since the current study design was a cross-sectional design and not a randomized controlled trial, this sample size calculation was used only as a guide.

3.6 Inclusion Criteria

The following patients were included in the study:

- ⩾ 18 years of age
- Male and female participants
- Patients admitted to ICU after trauma that were intubated and received mechanical ventilation

3.7 Exclusion Criteria

The following patients were excluded from the study:

- Imprisoned patients
- In ICU < 24 hours
- Mechanical ventilation < 24 hours
- Severe communication problems
- Diminished mental capacity
- People who lived outside of Johannesburg and surrounding areas
- Patients with lesions affecting the central nervous system
- Patients with terminal malignancy

3.8 Data Collection

Permission was obtained from the QualityMetric group to use the SF-36 questionnaire (License number: F1-071905-23163). Furthermore, permission was granted from the EUROQoL group to use the EQ-5D questionnaire. Permission from the hospitals' management was obtained in order to gain access to the hospital database and patient's files (see Appendix four). In order to identify potential subjects for the study, the admission books and records of the respective ICUs were searched for those patients who were six months after ICU discharge and eligible to partake in the study. Through this process, contact information was attained for those patients.

The subject was then contacted telephonically by a physiotherapist who was responsible for their care at the respective hospital and permission was sought from that person for the researcher to contact the patient and invite them to participate in the study. In addition to this, the person responsible for their care in ICU also explained the aims of the study to them and tried, as much as possible, to exclude those not eligible for the study. It was at this time that the person responsible for their care queried whether or not the patient had been intubated. Those that had been intubated had not recalled being intubated themselves but had been told of this fact by a family member after ICU discharge. Whether or not the patient had been intubated was later confirmed by the researcher by examining the hospital records once informed consent was attained.

Once permission was gained from the patient, the researcher contacted the person telephonically. The study aims and procedure was explained to the person in more detail to make sure that he/she understood what was expected of him/her. The person was then asked whether they would be interested in setting up a meeting with the researcher in order to participate in the research study. An appropriate time was arranged between the participant and the researcher to meet at the respective hospital that the participant frequents.

After eligibility of the participant was assessed by the researcher on the day of appointment and the participant was deemed suitable for the study, the researcher proceeded with the interview. Written informed consent was obtained at that time (see Appendix five). The participant answered two questionnaires, that is, the SF-36 (see Appendix one) and the EQ-5D (see Appendix two) in a self-administered fashion. The researcher was present to assist the participant with any questions that may have been unclear to him/her. The same researcher was present for each questionnaire completed. At the time of the interview, permission was sought from the subject to gain access and utilize their hospital information for the study.

Demographical information was collected for each participant using the participant's hospital file and ICU charts (see Appendix seven). This included age, gender, admission diagnosis, severity of illness as determined by the APACHE II score and length of ICU and hospital stay. The APACHE II score was calculated by the researcher using a freely available online calculator whereby the participant's vitals, blood results, GCS score and age on ICU admission were entered into the calculator. The ISS score was obtained from an administrator in the casualty department of the two hospitals. Once all information was gathered, data was analyzed.

3.9 Data Analysis

Data summary for discrete variables such as EQ-5D variables, gender and trauma type employed frequency, percentage and cross tabulation. Continuous variables were demographic information and outcome measures, VAS of the EQ-5D, SF-36 scale scores

and PCS and MCS. Trauma type and gender categories were compared with respect to continuous variables using Student's T-test and one-way analysis of variance (ANOVA). In the latter, when necessary, pair-wise comparisons between three trauma groups were done using the Bonferroni approach. Where homogeneity of variance between groups could not be assumed, the one-way ANOVA for ranks was performed i.e. a nonparametric approach was followed. With respect to EQ-5D parameters, trauma type and gender categories were compared using Fisher's exact test. Continuous outcome parameters such as the VAS, SF-36 scores and PCS and MCS were assessed in relation to continuous baseline parameters such as hospital and ICU length of stay using Pearson's-product-moment correlation coefficient. Data analysis was done using Stata Release 10 software and throughout testing was done at the 0.05 level of significance.

3.10 Ethical considerations

- Ethical clearance was obtained from the University of the Witwatersrand Human Research Ethics Committee (Protocol Number: M081133) to conduct this study (see Appendix three).
- Permission was granted from the respective hospitals to use the admission records of the subjects in order to source the patients and information needed for the study (see Appendix four).
- The subjects were contacted via a person who was responsible for their care and permission was attained from the patient to utilize their hospital information when they agreed to partake in the study.
- Informed consent was obtained from subjects prior to entering the study.
- Subjects were allowed to withdraw from this study at any time.

The results obtained through the above mentioned methodological process are described in chapter 4.

Chapter 4
Results

This chapter describes the results obtained from the cross-sectional study that was described in the previous chapter.

A total of 200 patients were admitted into the trauma ICU of Charlotte Maxeke Johannesburg Academic hospital from November 2008 – May 2009. Of these admissions, 31 deaths were recorded. The number of patients admitted into the trauma ICU at Milpark hospital from November 2008 – April 2010 totaled 1115 and 65 deaths were recorded here. The types of trauma seen at both hospitals varied between blunt and penetrating trauma, polytrauma and burn injuries. Not all admissions into the Milpark ICU presented with a diagnosis of trauma as this trauma unit also serves as an overflow to the surgical and respiratory ICUs. Recruitment was done at six months after discharge from ICU and information was obtained from the ICU admissions and discharge register. Not all contact information provided in the records was up to date and thus many potential participants could not be reached.

4.1 Study population

A total of 32 subjects (n = 32) were interviewed for this study at six months after discharge from ICU. Of these, four subjects (n = 4) were excluded from the study [not intubated and mechanically ventilated (n = 2); ventilated for less than 24 hours (n = 1); paraplegia (n = 1)]. Thus 28 subjects (n = 28) were eligible for inclusion in the study. Demographics and outcomes for these subjects are shown in Table 1.

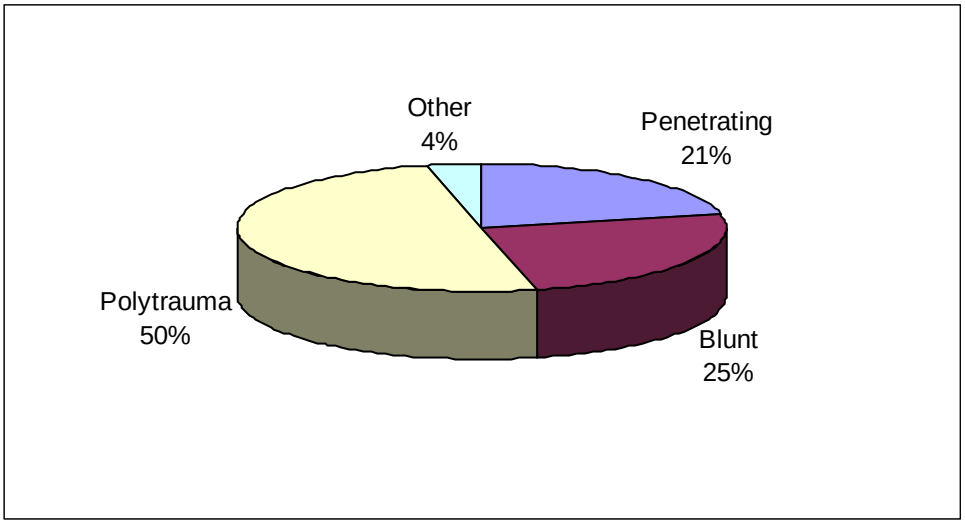
Table 1: Demographic and outcome information for enrolled subjects.

	Male			Female			Total		
	N	Mean	Standard deviation	n	Mean	Standard deviation	n	Mean	Standard deviation
Age (years)	23	36.8	± 12.5	5	37.4	14.9	28	36.9	± 12.7
LOS_{ICU} (days)	23	22.7	± 14.1	5	22.6	28.7	28	22.7	± 16.8
LOS_{Hosp}(days)	19	32.9	± 21.6	5	26.6	27.3	24	31.6	± 22.4
APACHE II	17	15.8	± 6.5	3	28.0	5.0	20	17.0	± 7.7
ISS	18	21.3	± 9.7	3	22.3	4.5	21	21.5	± 9.0

LOS: length of stay, ISS: injury severity score, APACHE: Acute Physiology and Chronic Health Evaluation score

Missing data is owing to the lack of hospital records for certain subjects. In this trauma population it was found that the vast majority of participants were male (82.1%).Thus more males were involved in trauma than females. There was no difference noted between the male and female subjects when it came to age, LOS in ICU and the ISS. Males had a longer stay in hospital than females. A difference in the APACHE II scores was noted between genders where the mean score for males was 15.8 compared with 28.0 for females. This higher mean score in APACHE II for females indicated a higher severity of illness in this population group. Distribution of subjects based on the type of trauma is illustrated in Figure 1.

Figure 1: Distribution of subjects according to type of trauma.



Half of the participants involved in the study were those with the diagnosis of polytrauma (n =14) where more than one body organ or part was somehow compromised. Blunt trauma accounted for 25% (n =7) of the participant population. Other trauma in the above figure refers to a patient with burn injuries (n=1).

4.2 Results based on EQ-5D questionnaire

4.2.1 Health related quality of life as measured with the EQ-5D

The EQ-5D was self-administered and assistance was only provided if the subject did not understand what was being asked. No attempt was made by the researcher to influence the subject's responses to the questions asked. Subjects were timed and took an average of five minutes to complete the questionnaire (with a variation of one and nine minutes). Table 2 displays the results from the descriptive portion of the EQ-5D.

Table 2: Report of descriptive portion of EQ-5D (n = 28).

	Mobility	Self-care	Usual activities	Pain/discomfort	Anxiety/depression
No problems	14 (50.0)	18 (64.3)	9 (32.1)	9 (32.1)	13 (46.4)
Some problems	14 (50.0)	10 (35.7)	19 (67.9)	17 (60.7)	13 (46.4)
Extreme problems	0	0	0	2 (7.1)	2 (7.1)

Results are reported as number (%)

Extreme problems were reported only in the pain/discomfort and anxiety/depression portions of the questionnaire for a small minority of the participant population at six months after discharge from ICU. This result implied that the subjects in this study recovered more rapidly in the physical domains of QOL. The majority of subjects had some problems in usual activities and pain/discomfort whilst a large number reported no problems in self care. When it came to mobility and anxiety/depression there was more or less an equal split in those reporting no problems versus those reporting some problems. The median score for the EQ-5D VAS was 65 with a mean value of 68 (± 26.1). The interquartile range was 50-95. This indicated that the state of health of these subjects was approaching the best imaginable at six months after ICU discharge but was not optimal yet.

4.2.2 Comparison of EQ-5D domains with demographics and outcomes

A comparison of the EQ-5D domains with the type of trauma and gender of the subjects is shown in Table 3.

Table 3: Comparison of EQ-5D domains with trauma type and gender (n = 27).

EQ-5D domain	Penetrating	Blunt	Polytrauma	Male	Female
Mobility					
No problems	4 (66.7)	3 (42.9)	6 (42.9)	12 (52.2)	2 (40.0)
Some problems	2 (33.3)	4 (57.1)	8 (57.1)	11 (47.8)	3 (60.0)
Extreme problems	0	0	0	0	0
Self-care					
No problems	5 (83.3)	3 (42.9)	9 (64.3)	13 (56.5)	5 (100.0)
Some problems	1 (16.7)	4 (57.1)	5 (35.7)	10 (43.5)	0
Extreme problems	0	0	0	0	0
Usual Activities					
No problems	3 (50.0)	1 (14.3)	5 (35.7)	7 (30.4)	2 (40.0)
Some problems	3 (50.0)	6 (85.7)	9 (64.3)	16 (69.6)	3 (60.0)
Extreme problems	0	0	0	0	0
Pain/discomfort					
No problems	2 (33.3)	1 (14.3)	6 (42.9)	7 (30.4)	2 (40.0)
Some problems	3 (50.0)	6 (85.7)	7 (50.0)	14 (60.9)	3 (60.0)
Extreme problems	1 (16.7)	0	1 (7.1)	2 (8.7)	0
Anxiety/Depression					
No problems	3 (50.0)	1 (14.3)	8 (57.1)	11 (47.8)	2 (40.0)
Some problems	3 (50.0)	5 (71.4)	5 (35.7)	10 (43.5)	3 (60.0)
Extreme problems	0	1 (14.3)	1 (7.1)	2 (8.7)	0
VAS					
Mean	72.3	58.6	71.1	—	—

Results expressed as number (%)

When analyzing the above results it was evident that in the mobility domain, the majority of the blunt and polytrauma groups reported having some problems with mobility in contrast to the majority of the penetrating trauma group who reported having no problems. A higher number of the penetrating trauma and polytrauma groups described themselves as having no problems in self-care. A greater number existed of those reporting some problems when it came to usual activities in the blunt and polytrauma groups whilst there is an equal split in those reporting no problems and some problems in the penetrating trauma group. Interestingly, the pain/discomfort and anxiety/depression domains were the only ones which yielded a response of extreme problems by the subjects. The penetrating and polytrauma groups described extreme problems in pain/discomfort; furthermore half of the aforementioned subjects in each group reported some form of problem in this domain. Subjects in the blunt trauma and polytrauma groups reported extreme problems with anxiety/depression. The majority of subjects in the blunt trauma group reported some problems in this domain whilst the majority of those with polytrauma reported none. The subjects in the penetrating trauma and polytrauma groups yielded higher mean scores in the VAS. The EQ-5D VAS was found to be moderately correlated with age ($r=-0.4$; $p=0.05$). Thus with an increase in age, a decrease in VAS was evident.

In a comparison between the genders, the males reported extreme problems in the pain/discomfort and anxiety/depression domains. Females seemed to report a higher incidence of some form of problem with anxiety/depression and mobility, whilst males exhibited a higher number of some form of problem with pain/discomfort and usual activities. The difference between the groups in the previous result was however not considerable. A difference between the genders existed in the self-care domain. All females reported having no problems in self-care; this was in contrast to results obtained for the male group.

Table 4 illustrates the comparison between the EQ-5D health states and the various outcome measures assessed.

Table 4: Comparison between EQ-5D health states and the various outcome measures assessed.

	ICU LOS		HOSPITAL LOS		APACHE II		ISS		AGE	
	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Mobility										
No problems	14.5	± 9.6	22.3	± 17.3	16.0	± 6.8	18.1	± 8.9	33.1	± 12.2
Some problems	30.9	± 18.7	40.8	± 23.7	18.5	± 8.2	23.5	± 8.7	40.6	± 12.4
Extreme problems	—	—	—	—	—	—	—	—	—	—
Statistical significance	p=0.01		p=0.04		p=0.51		p=0.19		p=0.12	
Self-care										
No problems	19.2	± 16.8	25.8	± 19.2	18.5	± 7.9	20.5	± 8.9	33.8	± 11.5
Some problems	29.0	± 15.8	45.7	± 24.8	16.0	± 7.6	23.0	± 9.5	42.5	± 13.3
Extreme problems	—	—	—	—	—	—	—	—	—	—
Statistical significance	p=0.14		p=0.04		p=0.51		p=0.56		p=0.08	
Usual Activities										
No problems	14.6	± 9.0	20.6	± 12.9	22.7	± 6.2	24.2	± 11.5	34.2	± 12.5
Some problems	26.5	± 18.4	38.2	± 24.6	15.4	± 7.3	20.4	± 8.0	38.2	± 12.9
Extreme problems	—	—	—	—	—	—	—	—	—	—
Statistical significance	p=0.08		p=0.06		p=0.05		p=0.40		p=0.45	
Pain/discomfort										
No problems	14.6	± 11.3	21.9	± 15.9	18.8	± 5.9	19.8	± 11.6	30.2	± 8.2
Some problems	25.2	± 18.5	36.4	± 24.7	16.9	± 8.5	20.3	± 7.6	39.5	± 13.8
Extreme problems	38.0	± 1.4	52.0	—	19.0	± 9.9	34.0	0	44.5	± 10.6
Statistical significance	p=0.13		p=0.14		p=0.66		p=0.92		p=0.08	
Anxiety/Depression										
No problems	20.7	± 13.9	27.5	± 15.9	18.8	± 8.3	21.3	± 9.5	33.1	± 11.3
Some problems	24.9	± 19.8	38.1	± 29.2	16.6	± 7.2	20.3	± 8.3	39.6	± 13.8
Extreme problems	21.0	± 22.6	29.0	± 32.5	12.0	—	34.0	—	44.0	± 11.3
Statistical significance	p=0.53		p=0.28		p=0.56		p=0.82		p=0.19	

Statistical significance was only found in a few relationships. In the mobility health state, the mean ICU LOS was 14.5 days (± 9.6) and 30.9 days (± 18.7) for those reporting no problems to those reporting some problems respectively. Thus, those who remained in ICU for a longer period of time experienced more problems with mobility. Furthermore, those subjects who described themselves as having some problem with mobility were found to have had a prolonged period of hospital stay as compared to those subjects who found no problem with mobility [mean hospital LOS = 22.3 days (± 17.3) for those reporting no problem and 40.8 days (± 23.7) for those reporting some problems].

Similarly, subjects who reported having some problems with self-care had a longer hospital LOS compared with those who reported no problems. The subjects who reported no problems spent 25.8 days (± 19.2) in hospital and those who reported some problems had a hospital LOS of 45.7 days (± 24.8) .

Interestingly, it was the subjects who described having no problems with usual activities, that had a higher mean APACHE II score [mean score = 22.7(±6.2)] compared to those who reported having some problems in this health state [mean APACHE II score = 15.4(±7.3)]. Thus it might be reasonable to conclude that the severity of injury of these subjects did not play a key role in hampering the subjects in their usual activities.

With regards to the pain/discomfort health state, an increased ICU and hospital LOS, APACHE II score and ISS as well as an increase in age, corresponded to deterioration in the aforementioned health state. This however was not statistically significant.

4.3 Results based on SF-36 questionnaire

The SF-36 was self-administered and assistance was only provided if the subject did not understand what was being asked. No attempt was made by the researcher to influence the subject's responses to the questions asked. Subjects where timed and took an average of 15 minutes to complete the questionnaire (with a variation of five and 25 minutes).

4.3.1 Health related quality of life as measured with the SF-36

Table 5 illustrates the domain and summary scores obtained from subjects who completed the SF-36 questionnaire.

Table 5: Domain and summary scores of the SF-36 questionnaire (n = 28).

	Domains								Summary Scores	
	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Mean	64.1	44.6	57.1	65.7	58.0	54.9	44.1	63.9	62.1	58.7
Standard Deviation	± 30.0	± 41.6	± 32.8	± 27.7	± 24.9	± 30.9	± 45.4	± 23.2	± 27.8	± 20.1

Data presented as means. PF: physical function, RP: role physical, BP: bodily pain, GH: general health, VT: vitality, SF: social functioning, RE: Role emotional, MH: mental health, PCS: physical component summary score, MCS: mental component summary score

A higher score in the above domains indicates better QOL whilst a lower score alludes to limitations in the respective domains of QOL (Orwelius et al, 2010). Lowest scores were reported in the RP and RE domains indicating problems with work or other daily activities as a result of physical health and emotional problems respectively. Physical component summary score was higher than MCS, thus subjects perceived having less physical limitations to QOL in their daily lives at six months after discharge from ICU.

4.3.2 Comparison of SF-36 domains with demographics and outcomes

No statistically significant relationship was found when comparing type of trauma and gender to the SF-36 domains and summary scores with the student's t-test (p=0.007-1.0). Pearson's-product-moment correlation coefficient showed that the PF domain score had a negative correlation to ICU and hospital stay as well as age (correlation coefficient (r) = -0.4 (p = 0.03), -0.4 (p = 0.03) and -0.6 (p = 0.00) respectively). Therefore, the PF domain is shown to have a moderate correlation with ICU and hospital stay whilst having a strong correlation with age. Thus, with an increase in number of days spent in ICU and in hospital and an increase in age, a decrease in the PF score was observed. Furthermore, statistical significance was observed in the correlation between age and GH [r = -0.4 (p=0.02)] and age and PCS [r = -0.5 (p=0.01)]. Both of the aforementioned results show

moderate correlations. Hence, an increase in age was associated with a decrease in GH and PCS. There was no statistical significance observed in the correlation of any other outcome measure to the SF-36 domains.

4.4 Comparison of the SF-36 and EQ-5D questionnaires

The comparison of information obtained from the SF-36 and EQ-5D questionnaires proved to be challenging. Thus, the various domains of the respective questionnaires which measure similar aspects of the subject's HRQOL will be grouped for the sake of the analysis of results for this study.

Physical functioning in the SF-36 refers to physical activities including bathing, dressing, climbing stairs and lifting (Ware Jr, Kosinski, Gandek, 2004). This can be associated with the mobility, usual activities and self-care domains of the EQ-5D. The mean PF value reported by our subjects was 64.1 (± 30.0); this alludes to the fact that subjects still experienced some form of problem with physical activities. Similarly, with the EQ-5D, 50% and 67.9% of subjects reported having some problems with mobility and usual activities respectively. Furthermore, 35.7% indicated having some problems in self-care. Thus, subjects had not reached optimal function in the physical domains of HRQOL as is evident from the results of both questionnaires.

The RP domain in the SF-36 relates to work or other daily activities as a result of physical health; this includes questions on limitations in the kind of work or daily activities, reducing the amount of time spent and difficultly performing work or other daily activities (Ware Jr, Kosinski, Gandek, 2004). Usual activities of the EQ-5D can be associated with such. The mean RP value was low at 44.6 (± 41.6) thus suggesting that subjects had difficulty in returning to work or performing their ADLs adequately at six months. The majority of subjects (67.9%) reported some problems in usual activities on the EQ-5D; however, there were no extreme problems noted. Thus both questionnaires reported problems in this area of HRQOL. Usual activities can also be compared with the SF domain of the SF-36 where social activities (both quantity and quality) due to physical and emotional problems are addressed (Ware Jr, Kosinski, Gandek, 2004). The mean SF

value was 54.9 (± 30.9), thus subjects had not resumed their social activities entirely at six months following discharge from ICU and experienced some form of limitation to QOL. The fact that a vast percentage of subjects reported having some problems in usual activities as per the EQ-5D, speaks to a similar conclusion.

Mean BP of the SF-36 was scored at 57.1 (± 32.8); a higher score indicated less pain and less limitation to QOL in this domain due to pain. When comparing this result to the EQ-5D, 60.7% of subjects reported some pain/discomfort and 7.1% reported extreme pain/discomfort. Therefore, as per the EQ-5D a large percentage of subjects were still limited by pain/discomfort at six months after discharge.

A higher value for the MH domain of the SF-36 implies feeling happy and calm. For this study group the mean value was 63.9 (± 23.2). Role emotional was the lowest recorded value of the SF-36 and thus suggested that subjects still experienced problems with work or other daily activities as a result of emotional problems. On the EQ-5D 46.4% and 7.1% of subjects experienced some problems and extreme problems with anxiety/depression respectively. It would thus be reasonable to deduce that emotional problems played a significant role in limiting these subjects in their daily lives.

The GH domain of the SF-36 can be compared with the VAS of the EQ-5D. General health was found to be 65.7 (± 27.7) and mean VAS was 65%. Therefore, although the subjects were recovering, their perception of their HRQOL was that it was sub-optimal.

No domain exists in the EQ-5D that can be compared with the VT domain of the SF-36.

During assessment of HRQOL, subjects required more time to complete the SF-36 questionnaire than the EQ-5D questionnaire. Furthermore, subjects often found the English language used in the SF-36 questionnaire difficult to comprehend and thus required much more assistance from the researcher in completing the SF-36 compared to the EQ-5D questionnaire. In a subjective observation by the researcher, subjects required less time to complete the EQ-5D as compared to the SF-36 and the amount of questions asked by the subjects whilst answering the EQ-5D was fewer.

In conclusion, both questionnaires yielded a similar result in that subjects reported a reduced HRQOL at six months following discharge from ICU. When comparing the results of such with demographics and outcome measures, there were few statistically significant correlations. Subjects required less time to complete the EQ-5D questionnaire and found it simpler and more user-friendly.

A discussion of the results described in this chapter is provided in chapter 5.

Chapter 5
Discussion

Intensive care is costly with the resultant state of the patient, both physical and mental, often not optimal. It thus becomes important to investigate the after effects of ICU and the patients' perceptions of such in order to put systems in place to address any adverse issues. One of the important findings of this study was that subjects who survived trauma presented with a reduction in HRQOL at six months following discharge from ICU. This chapter starts with a description of the characteristics of the study population and thereafter a discussion of the main findings will follow. Comparisons will be made between results obtained from the current study and those published in the literature by fellow researchers.

5.1 The Health related quality of life of survivors of critical illness as a result of trauma

5.1.1 Demographic characteristics of the study population

Road traffic accidents contributed to more than half of the subjects' admission to ICU. The type of injuries observed with this study confirm the findings of Norman et al (2007) as mentioned in the introduction chapter of this research report. The majority of the subjects in this study were male (82.1%). In their study of trauma patients, Ulvik et al (2008) also noted that males formed the vast majority of their sample (81%). This is also true in the research by van Aswegen et al (2010) where the short ventilation group consisted of 92.3% males and the long ventilation group of 96.6% males. Karachi, Hanekom, Faure (2011) noted that all subjects with an admitting diagnosis of traumatic injury were males. Thus it can be concluded that in a trauma population, males seem to be more involved than females. Cuthbertson et al (2005), Hofhuis et al (2008), Orwelius et al (2010) and Granja et al (2002) investigated HRQOL in mixed ICU populations and reported 69%, 61%, 57.9% and 57% males respectively that constituted their study populations. Although the four aforementioned studies had a predominantly male sample,

the percentage was not as dominant as in the studies investigating the trauma population exclusively.

The mean age in this study was 36.9 (± 12.7) years. This mean age is similar to other studies investigating HRQOL in trauma patients exclusively. Mean age for participants in the study by Ulvik et al (2008) was 39 years and van Aswegen et al (2010) reported a mean age of 28.3 years in their short ventilation group and 33.6 years in the long ventilation group. Mean age for the trauma population seems quite a bit younger than that reported by Cuthbertson et al (2005), Hofhuis et al (2008), Orwelius et al (2010), Granja et al (2002) and Karachi, Hanekom, Faure (2011) who described mean age as 60.5 years, 69 years, 58.2 years, 46 years and 54.3 years respectively.

The mean LOS for our sample was 22.7 days (± 16.8) in ICU and 31.6 days (± 22.4) in hospital. The ICU LOS for this sample was substantially longer than that of Ulvik et al (2008), Granja et al (2002), Orwelius et al (2010), Cuthbertson et al (2005) and Karachi, Hanekom, Faure (2011) where ICU LOS was less than or equal to seven days. Subjects in the long ventilation group in the study by van Aswegen et al (2010) had a mean ICU LOS of 26.6 days, which is more prolonged than seen in our sample but comparable. It should be noted that van Aswegen et al (2010) investigated HRQOL in patients who sustained penetrating trunk trauma exclusively. The majority of their subjects' management included repeated relook laparotomy procedures in theatre for abdominal washouts and eventual wound closure and this would have necessitated a longer duration of ICU stay. In a mixed ICU population, Hofhuis et al (2008) reported a mean ICU LOS of 15 days, furthermore, hospital LOS was described as being 33 days. This is similar to that reported by our study; however it is shorter than the long ventilation group in the research by van Aswegen et al (2010) where hospital LOS was 42.3 days.

5.1.2 Health related quality of life as measured with the EQ-5D

Subjects were found to experience problems in all of the five domains of the EQ-5D at six months after discharge. Extreme problems were reported by some subjects in the

pain/discomfort and anxiety/depression portions of the questionnaire at six months after discharge from ICU.

The HRQOL of our patient population was reduced when compared to the patient population in the study by Granja et al (2002) where HRQOL was measured six months after ICU discharge. In their study, Granja et al (2002) found that 37% of participants reported moderate to severe problems in mobility, 22% in self-care, 46% in usual activities, 45% in pain/discomfort and 54% in anxiety/depression. These results however, represent those of a mixed ICU population where only four percent of the sample had a diagnosis of trauma. Since those that experience trauma are generally younger and in good health prior to the incident, it might be reasonable to assume that their expectations of HRQOL after the traumatic incident will be reported as poor. A patient who underwent scheduled surgery for chronic disease and already suffered from reduced HRQOL prior to admission might report improved HRQOL after surgery. This factor could thus explain why the results from the current study showed reduced HRQOL as measured with the EQ-5D. The EQ-VAS of the trauma population in the study by Granja et al (2002) was 70; this is more or less in congruence with that reported in our study.

When investigating the HRQOL of trauma patients exclusively, Ulvik et al (2008) utilized the EQ-5D. In their sample, 40% of participants reported reduced mobility, 15% had limitations in self-care, 44% reported problems in usual activities, 58% suffered pain/discomfort and 35% had problems with anxiety/depression. Fewer participants reported problems in the EQ-5D domains in the aforementioned study than in the current study. Thus, our group of trauma survivors experienced more strain in their day to day lives. Ulvik et al (2008) however measured HRQOL at two to seven years after major trauma. The difference in time in the measurement of HRQOL can account for the difference in results. Our study measured HRQOL at six months after ICU discharge; at this stage, it would be expected that HRQOL would be improved from baseline but still not optimal (Hofhuis et al, 2008). By measuring HRQOL at a later stage after trauma, it could be expected that with time more participants would improve in the various domains. Thus it can be postulated, that due to the long term design of the study by Ulvik et al (2008), a larger number of participants were seen to improve in their health, while at

six months after ICU discharge, our trauma group still experienced limitations in HRQOL.

5.1.3 Health related quality of life as measured with the SF-36

With respect to the HRQOL as measured with the SF-36 questionnaire, participants were found to have not achieved optimal HRQOL in any of the domains nor with regard to the summary scores. Lowest scores were found in the RP and RE domains indicating problems with work or other daily activities as a result of physical health and emotional problems respectively. Subjects perceived having less physical limitation to HRQOL than limitations due to emotional factors in their daily lives at six months after discharge from ICU. During informal discussions with the participants, it was found that less than half had returned to work. Arguably, the implication of this fact is that many participants could be struggling with a reduced sense of self worth and lack of integration into their community. This fact could translate into lower MCS scores. However, a limitation of this research is that return to work was not assessed objectively.

Cuthbertson et al (2005) measured HRQOL using the SF-36 questionnaire at pre-ICU admission and at three, six and 12 months after ICU admission and with the EQ-5D questionnaire at 12 months after ICU admission. The authors reported that participants displayed reduced HRQOL in all domains of the SF-36 at six months after ICU discharge. When compared with the research of Cuthbertson et al (2005), subjects in the current study recorded lower domain scores in the PF, BP, SF, RE and MH domains. In contrast to our study, the MCS was documented as being higher than the PCS in the research by Cuthbertson et al (2005). This alludes to the fact that our patient population had more limitation in the mental domains than the physical domains. The participant population in the study by Cuthbertson et al (2005) was a mixed ICU population with only nine percent having suffered from trauma. This could thus explain the difference in results.

At six months after ICU discharge, Hofhuis et al (2008) found that the RE and MH domains had returned to pre-ICU admission values. However PF, RP, GH and SF

domains remained lower than pre-ICU admission values and values for the healthy population. These results were obtained for a mixed ICU population. The current study however, did not compare results obtained to pre-ICU admission nor to a healthy population. In contrast to the results obtained by Hofhuis et al (2008), this study population reported lower domain scores for BP,VT, SF, RE and MH at six months after ICU discharge. The PCS reported by Hofhuis et al (2008) was 38.9 (±11.2) and MCS was 51.2 (± 10.1). The PCS is thus substantially lower than in this study with MCS more or less comparable. In the current study however, PCS was reported as being higher than MCS thus demonstrating more limitations in the mental and emotional domains than the physical, this was not the case in the research by Hofhuis et al (2008).Moreover, in this study, the PF and GH domains were actually higher at six months after ICU discharge than the pre-ICU admission domain scores reported by Hofhuis et al (2008) with RP being in a similar range. Thus, the physical domain scores in our sample are higher than that detailed by Hofhuis et al (2008).

With the exception of GH and VT, all SF-36 domain scores in the current study were decreased when compared with the domain scores reported in the study by Orwelius et al (2010). The sample in the study by Orwelius et al (2010) was a mixed ICU population where 12% of the sample had a diagnosis of trauma. Thus a decreased HRQOL in the current study could be attributed to the fact that the trauma population was a previously healthy one. When investigating the HRQOL at six, 12, 24 and 36 months with the SF-36, Orwelius et al (2010) found no significant changes in any SF-36 domain mean scores except PF between six and 24 months, RP between six and 12 months and SF between six and 12 months. The current study did not investigate the changes in HRQOL over time, yet it may be said that according to the results of Orwelius et al (2010) where there was no considerable change in HRQOL over time, the measurement of HRQOL at six months provided a good depiction of the participant's current state of health.

In the South African context, Karachi, Hanekom, Faure (2011) showed that HRQOL was not optimal at 12 months after surgical ICU discharge. When compared to this research, all domain and summary scores are lower. Thus, the subjects in this research, report a far better HRQOL. The aforementioned authors described PF (43.5 ± 10), RP (44.5 ± 10.4)

and RE (43.1 ± 12.5) to be lower than the other HRQOL domains. This is in congruence with this research where RP and RE were seen to be the lowest values and are comparable to that reported by Karachi, Hanekom, Faure (2011). Moreover, in contrast to this research, Karachi, Hanekom, Faure (2011) found MCS to be higher than PCS.

Van Aswegen et al (2010) measured HRQOL at one and six months after hospital discharge in patients who had experienced penetrating trunk trauma. A statistically significant difference between the short and long ventilation groups was found for the PF, BP and GH domains and the PCS but not for the MCS. At six months after discharge the short ventilation group had a PCS of 57.2 (±5.5) and MCS of 51.8 (± 6.1). The long ventilation group reported PCS as 45.4 (±8.4) and MCS 53.8 (± 8.4). The participants in the current study reported higher PCS and MCS mean scores and also a higher PCS score than MCS score which is in contrast to the long ventilation group. Our sample however, consisted of different types of trauma while the research by van Aswegen et al (2010) included only those with penetrating trunk trauma. The difference in type of trauma and thus the experience of such could bring about a difference in perception of HRQOL. No other research exists in the South African context which measures HRQOL in a mixed trauma population.

5.2 Factors that affected health related quality of life

5.2.1 Gender

In the investigation of HRQOL with the EQ-5D in this study it was discovered that men reported extreme problems in domains that measured pain/discomfort and anxiety/depression. Furthermore, men experienced problems with self-care whilst none of the women reported problems in this domain. Women seemed to report a higher incidence of some form of problem with anxiety/depression and mobility. This finding is in agreement with Ulvik et al(2008) where women were found to experience more anxiety/depression and had a two and a half times greater risk than men of developing psychological problems. Furthermore, Granja et al (2002) found gender to be significantly associated with the mobility domain of the EQ-5D, where females reported

more problems. Orwelius et al (2010) found an association between gender and HRQOL when measured with the SF-36. No statistically significant relationship was however found when comparing gender to the SF-36 domain and summary scores in our study.

5.2.2 Age

In our research, there was no statistical significance found in the comparison of age and the EQ-5D descriptive portion; however there was an association with age and EQ-VAS which showed a moderate correlation. This same association was also described by Granja et al (2002) who also found age to be significant in the association with mobility, self-care, usual activities and pain/discomfort. A statistically significant comparison was outlined with age and PF, GH and PCS of the SF-36 in the current study whereby the relationship between age and PF yielded a strong correlation and that between age and GH and PCS yielded a moderate correlation . With an increase in age, a decrease in the aforementioned domains was observed. Hofhuis et al (2008) and Ulvik et al (2008) reported that age was not responsible for influencing changes in HRQOL.

5.2.3 Length of stay in the intensive care unit and hospital

In our study, statistical significance was reached in the association between ICU and hospital LOS in the mobility domain of the EQ-5D and between hospital LOS and the self care domain. Thus with an increase in time spent in ICU and in hospital, more limitation was found to be present in these domains. This result is in congruence with that reported by Granja et al (2002) where ICU LOS was shown to have a significant relationship with the mobility and self-care domains. A moderate association was observed between ICU and hospital LOS and the PF domain of the SF-36 only. Similarly, an increase in time spent in ICU and in hospital resulted in a decrease in the PF domain score. Orwelius et al (2010) described ICU LOS to have no association with HRQOL but hospital LOS was found to have a significant relationship with such.

5.2.4 Severity of illness

The mean APACHE II score was 17.0 (± 7.7) and ISS was 21 (± 21.5) which indicated a moderate to severe illness in our sample. When comparing severity of illness scores in the current study to that of other trauma populations, the results proved to be in a similar range. Ulvik et al (2008) described an ISS of 25 and van Aswegen et al (2010) reported an APACHE II score of 20.2 in the short ventilation group and 18.7 in the long ventilation group. In a mixed ICU population, Cuthbertson et al (2005), Hofhuis et al (2008), Orwelius et al (2010) and Granja et al (2002) detailed an APACHE II score of 18, 19.2, 15.6 and 13 respectively where only those participants in the study by Granja et al (2002) were shown to have mild illness.

Statistical significance was only observed in the relationship between APACHE II score and usual activities in our research. This same result was also noted by Granja et al (2002) who also described an association with mobility and EQ-VAS. No other association with HRQOL and severity of illness was found in our study. This is consistent with the findings of Hofhuis et al (2008) and Orwelius et al (2010) where APACHE II score did not influence changes in HRQOL. In contrast, Ulvik et al (2008) found that ISS was significantly associated with impaired HRQOL.

5.3 Exercise and its potential role in the rehabilitation of survivors of trauma

It is well known that physical fitness plays a key role in a person's ability to perform ADL, influences their ability to participate in sport and exercise and aids in improving QOL (Blair, LaMonte, Nichaman 2004). Physical fitness involves the cardiovascular, respiratory and musculoskeletal systems. The cardiovascular and respiratory systems are conditioned through aerobic exercise whereas the musculoskeletal system is conditioned through aerobic, resistance and flexibility exercises (Warburton, Nicol, Bredin 2006).
Exercise has also been shown to have beneficial effects on psychological status (Stathopoulou, Powers, Berry, Smits, Otto 2006). Stathopoulou et al (2006) conducted a meta-analysis investigating the effect of exercise intervention on mental health. It was

hypothesized that the mechanism of action of the beneficial effects of exercise can be attributed to both psychological and physiological factors. Physiological factors included changes in metabolism and availability of central neurotransmitters. Moreover, the sleep cycle is often disturbed in depression and anxiety, another physiological factor seen to improve with exercise was that of sleep regulation (Stathopoulou et al, 2006). Potential psychological effects of exercise included changes in coping strategies and the interruption of negative thoughts (Stathopoulou et al, 2006). Furthermore, exercise intervention was found to be beneficial as an adjunctive therapy to pharmacologic treatment and was shown to produce marked changes in anxiety sensitivity (Stathopoulou et al, 2006).

Rehabilitation programmes that consist of aerobic and resistance exercises are commonly used in the chronic cardiac and pulmonary disease populations with encouraging results (Lacasse, Goldstein, Lasserson, Martin 2006; Jolliffe, Rees, Thompson, Oldridge, Ebrahim 2001). Lacasse et al (2006) examined the effects of pulmonary rehabilitation on QOL and exercise capacity. Statistically significant improvements were found for all the outcomes and it was shown that pulmonary rehabilitation was effective in relieving dyspnoea and fatigue and in improving patients' emotional function. Moreover, Jolliffe et al (2001) showed beneficial effects of cardiac rehabilitation. The authors noted a reduction in all cause and cardiac mortality in those subjects undergoing exercise intervention and a comprehensive cardiac rehabilitation programme. Furthermore, there was a significant reduction in total cholesterol as well as low density lipoprotein (LDL) in the comprehensive cardiac rehabilitation group.

Jones and co-workers (2003) are the only researchers to date to test the effectiveness of a rehabilitation programme on the recovery of survivors of critical illness in a RCT. They compiled a 93-page rehabilitation package that consisted of a self-directed exercise programme, diagrams and illustrations. The manual also contained advice on a wide range of psychological, psychosocial and physical problems that the ICU survivor could expect to encounter after they had recovered from critical illness. Subjects (n = 69) and controls (n = 57) were comparable and were contacted telephonically three times per week after discharge to monitor progress however subjects in the experimental group

were also encouraged to use the self-help rehabilitation manual. All subjects were tested at follow-up clinics at eight weeks and six months. The authors found that the SF-36 physical function score for subjects in the experimental group was closer to normal and significantly different from those in the control group (Jones et al, 2003). In light of the above it might be reasonable to conclude that exercise therapy, commenced at one month after discharge from the hospital (to allow time for wound healing), might have a beneficial effect on the recovery of survivors of trauma.

5.4 Limitations and recommendations

The greatest limitation to the current study is that records for a portion of subjects could not be attained. This was problematic as data for the whole sample could not be retrieved for some outcome measures and thus may have influenced the significance of the associations of outcome measures to HRQOL. As the design of this study was retrospective, a possible solution to this problem would have been to collect consent and data while the patient was still in ICU and follow up with them six months later thus a prospective study design.

Many patients admitted to the trauma ICU had sustained their injuries at work. No contact details in the ICU admission register remained at discharge for the patient themselves but rather for their employer. In all instances, when the employer was contacted, it was discovered that that particular person was no longer working for them and no contact number/s were available to follow him/her up. It may be true that the injuries sustained due to the trauma left the subject unable to work. This sample was missed during the current study as these subjects were not contactable. It is unknown whether the inclusion of such subjects would have altered results to show further limitation/no limitation in HRQOL in this sample of trauma survivors.

This study focused on assessment of HRQOL only at one time point of the subject's recovery, that is, six months after ICU discharge. The selection of this particular time point only could have missed a significant improvement or a drastic drop in HRQOL. A recommendation for future research would be to measure HRQOL either before (at three

months) or after six months (at nine or 12 months) in order to examine the change in HRQOL that may or may not occur over time. Another recommendation would be to measure HRQOL on ICU admission by proxies. In this way it may be possible to ascertain by how much the HRQOL of the subject had deteriorated due to the traumatic insult and the ICU and hospital stay.

Furthermore, our data was not compared to population normative data as such data is currently not available for the South African population. It would be helpful if South African normative data were to exist for HRQOL as measured with the EQ-5D or the SF-36 and for that to be compared to a patient population in order to ascertain differences in HRQOL.

5.5 Conclusion of Discussion Section

This study proposed that survivors of trauma report a reduction in HRQOL six months after ICU discharge due to severity of illness and a prolonged stay in hospital. Our findings support this hypothesis with regard to a prolonged stay in hospital. It was also hypothesized that the SF-36 questionnaire gives a more accurate assessment of QOL at six months after ICU discharge than the EQ-5D questionnaire. Current findings suggested that most of the domains in the SF-36 could be compared with those in the EQ-5D except for the VT domain. Therefore the second hypothesis is supported by our results. In the researcher's observations, subjects in this study did report that the SF-36 was more difficult to understand and that they found the EQ-5D easier to interpret. It would be reasonable to conclude that the SF-36 questionnaire gives more detailed reports on HRQOL but that the EQ-5D questionnaire might be more user-friendly.

Chapter 6
Conclusion

With the progression of medical care, our societies are seeing an increase in those patients who survive intensive care management. The quality of life of these survivors is one that requires further investigation and thus the consideration of HRQOL may prove to be beneficial. Information on the HRQOL of survivors of critical illness in the South African population is scarce. This study is one of a few investigating this aspect.

With respect to the HRQOL as measured with the EQ-5D at six months after ICU discharge, subjects were found to have limitations in all of the five domains. Similarly, when HRQOL was measured with the SF-36, it was found that HRQOL was not optimal. From this result it may be deduced that the trauma population still experiences problems in their daily lives at six months after discharge. This result is of concern and it may be suggested that an intervention, in the form of a rehabilitation programme, targeted at improving functional as well as mental impairments in HRQOL, be conceptualized. Age, ICU and hospital LOS seemed to be the only outcome measures to be associated with limitations in HRQOL.

Both the EQ-5D and SF-36 reported a reduction in HRQOL at six months after ICU discharge. In the researcher's observations, subjects found the EQ-5D questionnaire to be more user-friendly and easier to understand. The SF-36 however, provided a more detailed account of HRQOL.

In conclusion, with the reduction in HRQOL of survivors of trauma seen at six months after ICU discharge, it may be suggested that an intervention aimed at addressing these problems be instituted.

References

- Abelha FJ, Santos CC, Maia PC, Castro MA, Barros H. 2007. Quality of life after stay in surgical intensive care unit. *BMC Anesthesiology* 7: 1-12
- Anas AA, Wiersinga WJ, de Vos AF, van der Poll T. 2010. Recent insights into the pathogenesis of bacterial sepsis. *The Netherlands Journal of Medicine* 68: 147-152
- Angus DC, Carlet J. 2003. Surviving Intensive Care: a report from the 2002 Brussels Roundtable. *Intensive Care Medicine* 29: 368-377
- Badia X, Diaz-Prieto A, Gorriz MT, Herdman M, Torrado H, Farrero E, Cavanilles JM. 2001. Using the EuroQol-5D to measure changes in quality of life 12 months after discharge from an intensive care unit. *Intensive Care Medicine* 27: 1901-1907
- Benitha R, Tikly M. 2007. Functional disability and health related quality of life in South Africans with rheumatoid arthritis and systemic lupus erythematosus. *Clinical Rheumatology* 26: 24-29
- Bhargava A, Booysen FLR. 2010. Healthcare infrastructure and emotional support are predictors of CD4 cell counts and quality of life indices of patients on antiretroviral treatments in Free State Province, South Africa. *AIDS Care* 22:1-9
- Black NA, Jenkinson C, Hayes JA, Young D, Vella K, Rowan KM, Daly K, Ridley S. 2001. Review of outcome measures used in adult critical care. *Critical Care Medicine* 29: 2119-2124
- Blair SN, LaMonte MJ, Nichaman, MZ .2004. The evolution of physical activity recommendations: how much is enough? *The American Journal of Clinical Nutrition* 79 (supplement):913S – 920S
- Boer KR, van Ruler O, Reitsma JB, Mahler CW, Opmeer BC, Reuland A, Gooszen HG, de Graaf PW, Hesselink EJ, Gerhards MF, Steller EP, Sprangers MA, Boermeester MA, De Borgie CA, Dutch peritonitis group .2007. Health related quality of life six months following surgical treatment for secondary peritonitis- using the EQ-5D questionnaire. *Health and Quality of Life Outcomes* 5: 1-12

- Cheung K, Oemar M, Oppe M, Rabin R. EQ-5D User Guide (2009). Basic information on how to use EQ-5D: Version 2.0. http://www.euroqol.org/fileadmin/user_upload/Documenten/PDF/User_Guide_v2_March_2009.pdf. Accessed 30 November 2010.
- Combes A, Costa MA, Trouillet JL, Baudot J, Mokhtari M, Gibert C, Chastre J. 2003. Morbidity, mortality, and quality-of- life outcomes of patients requiring ⩾ 14 days of mechanical ventilation. *Critical Care Medicine* 31: 1373-1381
- Cuthbertson BH, Scott J, Strachan M, Kilonzo M, Vale L. 2005. Quality of life before and after intensive care. *Anaesthesia* 60: 332-339
- De Rooij SAJA, Govers AC, Korevaar JC, Giesbers AW, Levi M, de Jonge E. 2008. Cognitive, functional, and quality-of-life outcomes of patients aged 80 and older who survived at least 1 year after planned or unplanned surgery or medical intensive care treatment. *JAGS* 56: 816-822
- Dowdy DW, Eid MP, Sedrakyan A, Mendez- Tellez PA, Pronovost PJ, Herridge MS, Needham DM. 2005. Quality of life in adult survivors of critical illness: A systematic review of the literature. *Intensive Care Medicine* 31: 611-620
- Dossett LA, Redhage LA, Sawyet RG, May AK. 2009. Revisiting the validity of APACHE II in the trauma ICU: Improved risk stratification in critically injured adults. *Injury* 40: 993-998
- Eddleston JM, White P, Guthrie E. 2000. Survival, morbidity, and quality of life after discharge from intensive care. *Critical Care Medicine* 28: 2293-2299
- Graf J, Koch M, Dujardin R, Kersten A, Janssens U. 2003. Health- related quality of life before, 1 month after, and 9 months after intensive care in medical cardiovascular and pulmonary patients. *Critical Care Medicine* 31: 2163- 2169
- Granja C, Teixeira-Pinto A, Costa- Pereira A. 2002. Quality of life after intensive care- evaluation with EQ-5D questionnaire. *Intensive Care Medicine* 28: 898-907
- Harris IA, Young JM, Rae H, Jalaludin BB, Solomon MJ. 2008. Predictors of general health after major trauma. *Journal of Trauma* 64: 969-974
- Heyland DK, Hopman W, Coo H, Tranmer J, McColl MA. 2000. Long-term health-related quality of life in survivors of sepsis. Short Form 36: A valid and reliable measure of health- related quality of life. *Critical Care Medicine* 28: 3599-3605

- Hofhuis J, Hautvast JLA, Schrijvers AJP, Bakker J. 2003. Quality of life on admission to the intensive care: can we query the relatives? *Intensive Care Medicine* 29:974-979
- Hofhuis JGM, Spronk PE, van Stel HF, Schrijvers GJP, Bakker J. 2007. Quality of life before intensive care unit admission is a predictor of survival. *Critical Care* 11:R78
- Hofhuis JGM, Spronk PE, van Stel HF, Schrijvers GJP, Rommes JH, Bakker J. 2008. The impact of critical illness on perceived health-related quality of life during ICU treatment, hospital stay, and after hospital discharge: A long-term follow-up study. *Chest* 133:377-385
- Hofhuis JGM, Spronk PE, van Stel HF, Schrijvers GJP, Rommes JH, and Bakker J.2008. The impact of severe sepsis on health-related quality of life: A long-term follow-up study. *Anesthesia and Analgesia* 107: 1957-1964
- Hofhuis JGM, van Stel H, Schrijvers AJP, Rommes JH, Bakker J, Spronk PE. 2009. Conceptual issues specifically related to health-related quality of life in critically ill patients. *Critical Care* 13:118-120
- Hofhuis JGM, van Stel H, Schrijvers AJP, Rommes JH, Bakker J, Spronk PE. 2009. Health-related quality of life in critically ill patients: how to score and what is the clinical impact? *Current Opinion in Critical Care* 15:425-430
- Hughes J, Jelsma J, Maclean E, Darder M, Tinise X. 2004. The health related quality of life of people living with HIV/AIDS. *Disability and Rehabilitation* 26: 371-376
- Jagodic HK, Jagodic K, Podbregar M. 2006. Long-term outcome and quality of life of patients treated in surgical intensive care: a comparison between sepsis and trauma. *Critical Care* 10:R134
- Jelsma J, Mkoka S, Amosun L, Nieuwveldt J. 2004. The reliability and validity of the Xhosa version of the EQ-5D. *Disability and Rehabilitation* 26: 103-108
- Jelsma J, Maclean E, Hughes J, Tinise X, Darder M. 2005. An investigation into the health- related quality of life of individuals living with HIV who are receiving HAART. *AIDS Care* 17: 579-588

- Jolliffe J, Rees K, Taylor RRS, Thompson DR, Oldridge N, Ebrahim S. 2001. Exercise-based rehabilitation for coronary heart disease. *Cochrane database of systematic reviews* 1. Art. No.: CD001800.DOI:10.1002/14651858.CD001800.
- Jones C, Skirrow P, Griffiths RD, Humphris GH, Ingleby S, Eddleston J, Waldmann C, Gager M. 2003. Rehabilitation after critical illness. *Critical Care Medicine* 31: 2456 – 2461
- Kaarlola A, Tallgren M, Pettla V. 2006. Long-term survival, quality of life, and quality-adjusted life-years among critically ill elderly patients. *Critical Care Medicine* 34: 2120-2126
- Karachi F, Hanekom S, Faure M. 2011. Health-related quality of life of patients 12 months following surgical intensive care discharge. *The South African Journal of Physiotherapy* 67(1): 28-34
- Kvale R, Flaaten H. 2003. Changes in health-related quality of life from 6 months to 2 years after discharge from intensive care. *Health and Quality of Life Outcomes* 1: 1-9
- Lacasse Y, Goldstein R, Lasserson TJ, Martin S. 2006. Pulmonary rehabilitation for chronic pulmonary disease. *Cochrane database of systematic reviews* 14. Art. No.: CD003793.DOI:10.1002/14651858.CD003793.pub2.
- Louwagie GM, Bachmann MO, Meyer K, Booysen FR, Fairall LR, Heunis C. 2007. Highly active antiretroviral treatment and health related quality of life in South African adults with human immunodeficiency virus infection: A cross-sectional analytical study. *BMC Public Health* 14: 244
- Matzopoulos RG, Prinsloo M, Buchart A, Peden MM, Lombard CJ. 2006. Estimating the South African trauma caseload. *International Journal of Injury Control and Safety Promotion* 13:49-51
- Myhren H, Ekeberg O, Stokland O.2010. Health-related quality of life and return to work after critical illness in general intensive care unit patients: A 1-year follow-up study. *Critical Care Medicine* 38: 1554-1561
- Norman R, Matzopoulos R, Groenewald P, Bradshaw D. 2007.The high burden of injuries in South Africa. *Bulletin of the World Health Organization* 85:695-702

- O'Keefe EA, Wood R. 1996. The impact of human immunodeficiency virus (HIV) infection on quality of life in a multiracial South African population. *Quality of Life Research* 5:275-280
- Orwelius L, Nordlund A, Nordlund P, Simonsson E, Backman C, Samuelsson A, Sjoberg F. 2010. *Critical Care* 14:R67
- Robberstad B, Olsen JA. 2010. The health related quality of life of people living with HIV/AIDS in sub-Saharan Africa-a literature review and focus group study. *Cost Effectiveness and Resource Allocation* 8:5
- Rogers J, Ridley S, Chrispin P, Scotton H, Lloyd D. 1997. Reliability of the next of kins' estimates of critically ill patients' quality of life. *Anaesthesia* 52:1137-1143
- Rutledge R, Fakhry S, Rutherford E, Muakkassa F, Meyer A. 1993. Comparison of APACHE II, Trauma Score, and Injury Severity Score as Predictors of Outcome in Critically Injured Trauma Patients. *The American Journal of Surgery* 166: 244-247
- StataCorp. 2007. *Stata Statistical Software: Release 10*. College Station, TX: StataCorp.
- Stathopoulou G, Powers MB, Berry AC, Smits JA, Otto MW. 2006. Exercise interventions for mental health: A quantitative and qualitative review. *Clinical Psychology: Science and Practice* 13: 179-193
- Topp R, Ditmyer M, King K, Doherty K, Hornyak J. 2002. The effect of bed rest and potential of prehabilitaion on patients in the Intensive Care Unit. *AACN Clinical Issues* 13: 263-276
- Ulvik A, Kvale R, Wentzel-Larsen T, Flaatten H. 2008. Quality of life 2-7 years after major trauma. *Acta Anaesthesiologica Scandinavica* 52: 195-201
- Van Aswegen H, Richards GA, Goosen J, Becker P. 2010. The effect of penetrating trunk trauma and mechanical ventilation on the recovery of adult survivors after hospital discharge. *South African Journal of Critical Care* 26:25-32
- Van der Merwe E, Kidd M, Metzker S, Bolliger CT, Irusen EM. 2005. Validating the use of the APACHE II score in a tertiary South African ICU. *South African Journal of Critical Care* 21:46-54
- Warburton DER, Nicol CW, Bredin SSD. 2006. Prescribing exercise as preventive therapy. *Canadian Medical Association Journal* 174: 961 – 975

- Ware Jr JE, Kosinski M, Gandek B. SF-36 Health Survey: Manual & Interpretation Guide. Lincoln, RI: QualityMetric Incorporated, 1993, 2000.
- Ware Jr JE, Sherbourne CD.1992. The MOS 36-Item Short-Form Health Survey (SF-36). *Medical Care* 30:473-483
- Wehler M, Geise A, Hadzionerovic D, Aljukic E, Reulbach U, Hahn EG, Strauss R. 2003. Health-related quality of life of patients with multiple organ dysfunction: Individual changes and comparison with normative population. *Critical Care Medicine* 31:1094-1101
- Winkelman C.2004. Inactivity and inflammation. *AACN Clinical Issues* 15: 74-82

Appendices

Appendix One: SF-36 Questionnaire

U.K.

SF-36

5/93

IQOLA SF-36 Standard U.K.
Version 1.0

SF-36 HEALTH SURVEY

INSTRUCTIONS: This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

1. In general, would you say your health is:

(circle one)

Excellent 1

Very good 2

Good 3

Fair 4

Poor 5

2. Compared to one year ago, how would you rate your health in general now?

(circle one)

Much better now than one year ago 1

Somewhat better now than one year ago 2

About the same as one year ago 3

Somewhat worse now than one year ago 4

Much worse now than one year ago 5

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

(circle one number on each line)

ACTIVITIES	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
a. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing **several** flights of stairs	1	2	3
e. Climbing **one** flight of stairs	1	2	3
f. Bending, kneeling, or stooping	1	2	3
g. Walking **more than a mile**	1	2	3
h. Walking **half a mile**	1	2	3
i. Walking **one hundred yards**	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

(circle one number on each line)

	YES	NO
a. Cut down on the **amount of time** you spent on work or other activities	1	2
b. **Accomplished less** than you would like	1	2
c. Were limited in the **kind** of work or other activities	1	2
d. Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

(circle one number on each line)

	YES	NO
a. Cut down on the **amount of time** you spent on work or other activities	1	2
b. **Accomplished less** than you would like	1	2
c. Didn't do work or other activities as **carefully** as usual	1	2

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?

(circle one)

Not at all 1

Slightly 2

Moderately 3

Quite a bit 4

Extremely 5

7. How much bodily pain have you had during the past 4 weeks?

(circle one)

None 1

Very mild 2

Mild 3

Moderate 4

Severe 5

Very severe 6

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

(circle one)

Not at all 1

A little bit 2

Moderately 3

Quite a bit 4

Extremely 5

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks -

(circle one number on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
a. Did you feel full of life?	1	2	3	4	5	6
b. Have you been a very nervous person?	1	2	3	4	5	6
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
d. Have you felt calm and peaceful?	1	2	3	4	5	6
e. Did you have a lot of energy?	1	2	3	4	5	6
f. Have you felt downhearted and low?	1	2	3	4	5	6
g. Did you feel worn out?	1	2	3	4	5	6
h. Have you been a happy person?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

(circle one)

All of the time 1

Most of the time 2

Some of the time 3

A little of the time 4

None of the time 5

11. How TRUE or FALSE is each of the following statements for you?

(circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get ill more easily than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

Appendix Two: EQ-5D Questionnaire

EQ-5D Questionnaire

By placing a tick in one box in each group below, please indicate which statements best describe your own state of health TODAY.

Mobility

I have no problems in walking about ❑

I have some problems in walking about ❑

I am confined to bed ❑

Self-Care

I have no problems with self-care ❑

I have some problems washing or dressing myself ❑

I am unable to wash or dress myself ❑

Usual Activities (*e.g. work, study, housework, family or leisure activities)*

I have no problems with performing my usual activities ❑

I have some problems with performing my usual activities ❑

I am unable to perform my usual activities ❑

Pain/Discomfort

I have no pain or discomfort ❑

I have moderate pain or discomfort ❑

I have extreme pain or discomfort ❑

Anxiety/Depression

I am not anxious or depressed ❑

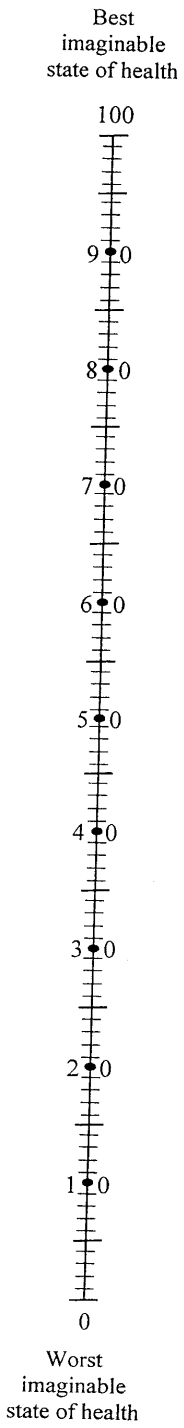
I am moderately anxious or depressed ❑

I am extremely anxious or depressed ❑

To help people say how good or bad their state of health is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale, in your opinion, how good or bad your own health is today. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

Your own state of health today



Appendix Three: Ethics clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Schneiderman

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M081133**
PROJECT	The Health Related Quality of Life of Survivors of Critically Illness as Measured with the SF-36 and EQ-5D Questionnaire at Six Months Post Discharge
INVESTIGATORS	Miss J Schneiderman
DEPARTMENT	Physiotherapy Department
DATE CONSIDERED	08.11.28
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.01.15 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr H Van Aswegen

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix Four: Permission from hospitals to conduct research

Private bag X39, Johannesburg 2000, South Africa
Tel: +27 (0) 11 488 4911, Fax: +27 (0) 11 643 1612
www.johannesburghospital.org

Gauteng Department of Health

Office of the CEO
Enquiries: M. Motjelele
(011): 488-3792 / 3
(011) 488-3753

05th February 2009

Miss J Schneiderman
Senior Physiotherapist
Helen Joseph Hospital

Dear Miss Schneiderman

RE: Permission to Conduct a Study re: "The Health Related Quality of Life of Survivors of Critical Illness as measured with the SF – 36 and EQ – 5D Questionnaires at 6 months after discharge"

Permission is granted for you to conduct the above research as indicated in your request provided:

1. The Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. S. B. Mfenyana
Acting Chief Executive Officer

Charlotte Maxeke Johannesburg Academic Hospital

Netcare Milpark Hospital

Tel: +27 (0) 11 480 5600
Fax: +27 (0) 11 482 3317
9 Guild Road,Parktown West, South Africa
PO Box 91155, Auckland Park, 2006, South Africa
www.netcare.co.za

20 April 2009

Dear Jenny

Re: M081133-The Health Related Quality of Life of Survivors of Critical Illness as measured with the SF-36 and EQ-5D Questionnaire at Six Months Post Discharge

The above mentioned proposal has been reviewed by the Netcare Milpark Ethics Committee and approval has been granted.

We wish you well with recruitment.

You are reminded to submit your findings to Milpark Ethics on completion of the study.

Thank you

Yours sincerely

1

Appendix five: Informed consent

INFORMED CONSENT

- I hereby confirm that I have been informed by the researcher, Jenny Schneiderman about the nature, conduct, benefits and risks of the study:
  The Health Related Quality of Life of survivors of critical illness as measured with the SF-36 and EQ-5D questionnaires at six months after discharge.

- I have also received, read and understood the above written information (Participant Information Leaflet and Informed Consent) regarding the study.

- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

- I may, at any stage, without prejudice, withdraw my consent and participation in the study.

- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

PARTICIPANT:

Printed Name	Signature / Mark or Thumbprint	Date and Time

I, Jenny Schneiderman, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

RESEARCHER:

Printed Name	Signature	Date and Time

Appendix six: Information document

INFORMATION DOCUMENT

The Health Related Quality of Life of survivors of critical illness as measured with the SF-36 and EQ-5D questionnaires at six months after discharge.

Hello, my name is Jenny Schneiderman and I am a current postgraduate student at the University of the Witwatersrand.

You are invited to consider participating in a research study. Your participation in this study is entirely voluntary. Before agreeing to participate, it is important that you understand the following explanation of the purpose of the study, the study procedures and your right to withdraw from the study at any time.

This information leaflet is to help you to decide if you would like to participate. You should fully understand what is involved before you agree to take part in this study. If you have any questions, do not hesitate to ask me. You should not agree to take part unless you are satisfied about all the procedures involved. If you decide to take part in this study, you will be asked to sign this document to confirm that you understand the study.

Purpose of the study:

The purpose of this study is to investigate the quality of life of survivors of trauma and aims to explore which tool is more appropriate to use in determining this.

Study details:

As a participant in the study, you will be required to fill out two separate questionnaires in a face to face interview with the researcher. This process is estimated to take an hour. The study is being conducted at the Johannesburg General and Milpark Hospitals and will involve approximately thirty six participants. The filling out of your questionnaires will take place at the hospital which you frequent. The questions in the questionnaires ask about your views about your health. Your medical records from your stay in ICU will be accessed to formulate the results of this study.

Risks:

There are no risks in participating in this study.

Benefits:

By participating in this study you will be adding to our knowledge base about the quality of life of survivors of critical illness and by so doing, you are aiding us to draw up adequate treatment protocols in the future.

Rights as a participant in this study:

Voluntary:

Your participation in this study is entirely voluntary and you can decline to participate, or stop at any time, without stating any reason.

Withdrawal:

Your withdrawal will not affect your access to other medical care.

Confidentiality:

All information obtained during the course of this study, including hospital records, personal data and research data will be kept strictly confidential.

Reimbursement for study participation

You will not be paid to participate in this study but your transport will be reimbursed adequately.

Ethical approval:

This study protocol has been submitted to the University of the Witwatersrand, Human Research Ethics Committee (HREC) and written approval has been granted by that committee.

The 24-hour telephone number through which you can reach me is 0845620289.

If you want any information regarding your rights as a research participant, or complaints regarding this research study, you may contact Prof. Cleaton-Jones, Chairperson of the University of the Witwatersrand, Human Research Ethics Committee (HREC), which is an independent committee established to help protect the rights of research participants at (011) 717 2229

…… ……

Signed Date

Appendix seven: Data collection sheet

DATA COLLECTION SHEET

PARTICIPANT CODE: _____

AGE: _____

ADMISSION DIAGNOSIS:_____

LENGTH OF STAY IN ICU: _____

INCOME: _____

CLINICAL DATA FOR APACHE II SCORE

TEMPERATURE:_____

SYSTOLIC BP: _____ DIASTOLIC BP: _____

MAP: _____

HEART RATE: _____ RESPIRATORY RATE: _____

FiO_2: _____

pH: _____ PO_2: _____

HCO_3: _____ PCO_2: _____

SERUM SODIUM:_____ SERUM CREATININE:_____

SERUM POTASSIUM: _____ WBC: _____

HCT (%): _____

ACUTE RENAL FAILURE: ☐ YES ☐ NO

CHRONIC ORGAN FAILURE: ☐ YES ☐ NO
☐ YES AND NON-OPERATIVE PATIENT
☐ YES AND EMERGENCY POST-OPERATIVE PATIENT
☐ YES AND ELECTIVE SURGERY PATIENT

GCS:_____

INJURY SEVERITY SCORE:

Head and Neck: _____

Face: _____

Chest: _____

Abdomen: _____

Extremity: _____

External: _____

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable